INITIATIVES TO PROMOTE SPACE COMMERCIALIZATION

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BEFORE THE

SUBCOMMITTEE ON
SPACE SCIENCE AND APPLICATIONS

OF THE

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SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

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INITIATIVES TO PROMOTE SPACE COMMERCIALIZATION

TUESDAY, JUNE 19, 1984

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS,
Washington, DC.

The subcommittee met, pursuant to call, at 2 p.m., in room 2318, Rayburn House Office Building, Hon. Harold L. Volkmer (chairman of the subcommittee) presiding.

Mr. VOLKMER. The Subcommittee on Space Science and Applications will come to order.

Today the subcommittee convenes to consider recommendations and initiatives that will benefit space commercialization. The subcommittee recently completed consideration of several legislative proposals dealing with space commercialization, including the Land Remote-Sensing Act, the Commercial Space Launch Act and the NASA Authorization Act.

These measures do not represent the end of this subcommittee's actions on space commercialization, however, they are only the beginning. Space commercialization goes far beyond just land remote-sensing satellites and expendable launch vehicles. It involves an array of application payloads and enabling space technology dealing with such things as advanced communications, materials processing, upper stages, utility platforms and others.

The focus of this hearing is to examine initiatives that will encourage and enable expansion of all possible commercial space activities to the maximum extent possible. We have seen the satellite communication industry explode into a mature, successful commercial space venture. There is no reason why we cannot expand this success to include other application areas.

This subcommittee is committed to furthering space commercialization and I am encouraged by the attention given to this matter by this administration.

Last year, NASA initiated a study to develop an agency policy and program on space commercialization. Here with us today to present the findings and recommendations of this study is the Administrator of NASA, James Beggs. I have reviewed Mr. Beggs' statement, and I must express my appreciation for not being overwhelmed by details. [Laughter.]

Mr. VOLKMER. Also here today are representatives from industry who will discuss recommendations they made to the administration

on space commercialization in a different study conducted by the White House.

I would like to thank these individuals—Jack Townsend, president of Fairchild Space Co.; Dick Kline, from Grumman Aerospace; and Bob Hood, from McDonnell Douglas—for being with us to share their views on Government actions benefiting space commerce.

Our first witness, however, is a colleague whose interest and prominent involvement in space commercialization is well recognized—Congressman Ed Zschau, Republican from California. We welcome you here and look forward to hearing your views on this important matter.

Before proceeding with your testimony, I would like at this time to have the statement of the ranking minority member, Mr. Lujan of New Mexico, appear right after my statement. Mr. Lujan is unavoidably detained at this time, but hopefully will be able to be here to join us at a later time.

[The opening statement of Mr. Lujan follows:]

OPENING STATEMENT OF THE HONORABLE MANUEL LUJAN, JR.

Thank you, Mr. Chairman. Although the White House has not yet officially released the results of the Space Commercialization Task Force, it will be interesting and helpful to get this early look at some of the results from the Task Force during the hearing. I understand that the study deals with government actions that could encourage commercial uses of space. This provides us, as a nation, with a great opportunity.

Throughout the history of the United States, our country has had a leadership role in the development of new technology. This technological leadership has been a major factor in American prosperity. We are now entering a new era where we are competing in a world market. There has been a great deal of discussion over the past few years on how to increase our nation's industrial competitiveness and how to assure continued American leadership in technology. Much of the debate has focussed on the government role and ignored the role of the American entrepreneur. There seems to be an assumption that technology innovation is something that can be manufactured by government planning—and government spending.

The favorite recommendation is that we model our industrial policy after the Japanese. This means the government would play an active role in deciding which industries to promote with financing, with subsidies, with retraining programs, with taxpayer dollars.

But the Japanese business and government leaders, along with their counterparts in other Asian and European countries, are looking at the U.S. way of doing things. Our industrialized competition is impressed by the vitality of the American economy, and they are jealously looking at us as their role models, especially the entrepreneurs from Silicon Valley, including our first witness this afternoon, Congressman Ed Zschau from California.

The Task Force will be on the right track in emphasizing administrative and legislative actions which would eliminate the various barriers and disincentives. The Task Force will be on the right track in giving the American entrepreneurial geniuses the tools they need and then stand back. The government can also provide research and development support. The commercialization of space would then be a sure success.

However, we will have to be careful to avoid getting a situation where the government competes with the private sector.

This is already a sensitive issue with the first step in space commercialization—transportation. The Space Shuttle is now a keystone in the coming commercial uses of space. It is hard to imagine how we can conduct manufacturing in space without the Shuttle, or how we can use space as a unique research facility without the Shuttle, or how we could operate the Space Station without the Shuttle. The Shuttle will play a critical role in the future space economy.

The confusion and controversy arises when we discuss using the Shuttle for the first major commercial use of space—communications satellites. Communications satellites can be launched by the Shuttle or by ELV's. However, the ELV's are not a

practical method of transportation for future commercial users. The wisest approach would be to make those missions that use the unique capabilities of the Shuttle the first priority—reflected in price and access—and encourage the communications firms to use the U.S. ELV operators. That is the best bargain for the taxpayers. Then the U.S. Government is not in the ridiculous position of competing with the U.S. private sector. Then NASA is providing the appropriate and invaluable R&D support, and not trying to run a business. The new areas of commercialization have greater access to the Shuttle. And we can all turn our attention on developing the fullest commercial use of space with the resulting benefits to the U.S. economy.

I look forward to discussing these and other ideas with one witness this afternoon. Thank you, Mr. Chairman.

Mr. VOLKMER. At this time, I will recognize my colleague, Hon. Ed Zschau.

STATEMENT OF HON. ED ZSCHAU, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. ZSCHAU. Thank you very much, Mr. Chairman. I will be brief.

I, too, am anxious to learn of the mystery that lies behind Mr. Beggs' brief outline, and I know that the committee wants to get into that.

I appreciate the opportunity to express some views, some observations on this issue, however. I want to commend not only this subcommittee, but the full Committee on Science and Technology for providing leadership on the debate over the issue: What should be the proper role of Government in fostering technological advancement?

In prior hearings that various subcommittees of this full committee have held, the issue has been raised whether there should be direct involvement by some sort of central planning activity—a national industrial policy approach to promoting technological advancement—or whether the proper role of Government is to create an environment in which the private sector is able to to do the job in the future that it's done so well in the past.

I happen to be a proponent of the latter view. I feel that rather than targeting on specific industries or specific technologies, the proper role of the Federal Government is to target on the process by which growth and companies are fostered and new ideas are likely to flourish—that is, to create an environment in which the private sector can do the work in the future that it's done so well in the past.

There are, in my view, some prerequisites for such an environment in which Government plays, however, a direct role.

One, you have to have a base of research, basic research, a commitment to basic research that I feel is a proper role of the Federal Government.

Second, you have to have incentives for risk taking. New technological advances don't come risk free, and so the environment should be there for the investors, the entrepreneurs, the innovators, the engineers to take the risks associated with new technological innovation.

Three, there should be ample market opportunities in order to inspire those who are willing to take the risks, knowing that there is some return in it for them.

I'd like to tell briefly a story that's been important to the district that I have the privilege of representing, the area in California called the Silicon Valley. It's really just very briefly one thread of the tapestry of Silicon Valley.

In 1947, at Bell Telephone Laboratories, after many years of basic research—research that private companies of lesser magnitude would not have been able to afford to do—three inventors, William Shockley, John Bardeen, and Walter Brattain invented the transistor. About 9 years later, Shockley came to California, to Palo Alto, CA, where his mother resided, and formed Shockley Labs to exploit this research idea, and it was about that time that he and the two others won the Nobel prize for that fundamental research.

That company, Shockley Labs, never became very famous, but it launched Silicon Valley. Shockley hired about eight bright engineers. They got new ideas. One of those, Bob Noyce, got the idea of putting several transistors into what he called an integrated circuit, and left Shockley Labs, got some funding from an industrialist, Sherman Fairchild, to start Fairchild Semiconductor, and out of that, many other semiconductor companies were founded.

He left there in 1968 to start a new company based on the idea of putting a whole computer on a chip, and so the microprocessor was born in 1968, and in the mid-1970's, a group of hobbyists around the Stanford University area, formed a club called the "Home Brew Computer Club," where they got the idea of putting one of these microprocessors together with a televion set and keyboard to make a personal computer. Two members of that club, Steve Jobs and Steve Wozniak, formed a company in a garage—Apple Computer—and now that company has a billion dollars in sales. It really launched the personal computer revolution.

I tell this story because I think there is an analogy of where we are in space as to where we were in semiconductor development back in 1956. Out of the research of Bell Labs, there was the basic idea of a semiconductor, but there wasn't a semiconductor industry in 1976.

It took the risk taking, the investing, the trying of new ideas of many people, in addition to those that I mentioned, to create not only the semiconductor industry, but the computer industry, the personal computer industry that has become so pervasive in the last couple of decades.

I believe that now is the time for commercial exploitation of space. I think we have the prerequisites in place. I think we have the technical base in place; I think we have the capital, the venture capital as a result of the reduction of the capital gains tax in 1978 and 1981. Last year, there was about $4 billion of new venture capital available, capital in sufficient quantity for people to launch a new space commercialization business.

I think there is a market opportunity now, the market opportunity of launching satellites into space.

So the prerequisites that I mentioned—the research foundation, the incentives for the risk takers, the supply of capital, the market opportunity—are there, and now is the time when that transition from basic research into commercialization can take place in space, much as it did in the semiconductor industry nearly 30 years ago.

Government policy can either help make that happen or make it more difficult for that to happen. Your committee will play a great role in determining whether the Government policy will enhance the environment for commercial exploitation of space or whether it will be detrimental.

My feeling would be this: That the Government-sponsored research should focus on the basic research program, extending the frontiers, trying new ideas, such as, for example, manufacturing techniques in space that have no commercial justification now, but will if the basic research is done.

I believe that incentives for risktaking by entrepreneurs to commercialize space can be affected by Government policy. The Executive order that the president signed to rationalize the regulation of space exploitation by putting it all under the Department of Transportation is an important step forward to making it easier for entrepreneurs to take advantage of this opportunity.

Extending or making permanent the R&D tax credit—an issue that's being debated as we speak by the Conference Committee considering the tax bill—I think will be an important incentive for risktaking, and we have to maintain in this country a climate for investment, which has to do with not only our tax policy but our overall fiscal policy.

I think an area that is going to be very important as to whether there's going to be commercial exploitation of space or whether it will fail will be whether or not a market opportunity exists, and I believe that, to the extent that the Federal Government is involved in seizing the market opportunity by doing commercial launches of satellites, the market opportunity as perceived by the entrepreneurs will be diminished. We may have the research base and we may have the capital, but if it appears that, on an unfair basis, the NASA Shuttle Program is competing with the expendable launch vehicles in the private sector, the market opportunity will be diminished and perhaps the incentive for commercialization reduced.

It would, therefore, be my strong recommendation that the charter of NASA be focused on extending the frontiers, doing the basic research that needs to be done, and that the pricing of whatever commercial activities that the shuttle is involved in—in putting satellites into space—be based on a fair, full-cost analysis of the launch, rather than on a subsidized basis.

My feeling is that if those insertions of satellites in space are done on a subsidized basis, the market opportunity for the private sector will be diminished and this chance we have to convert from basic research into a thriving commercial business may be thwarted in its very beginning.

I appreciate, Mr. Chairman, the chance to make these observations. I should have said at the outset, although I am sure that you're well aware, that I don't consider myself an expert on space technology, but I do feel that my background in innovation generally may be applicable to some of the issues that you face on this question.

Mr. VOLKMER. Thank you very much, Congressman Zschau.

At this time, I will recognize the gentleman from California, Mr. Brown, for any questions he may have.

Mr. BROWN. Thank you very much, Mr. Chairman.

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I do appreciate the comments made by our colleague and I think they are on target and I would like to make just one inquiry relating to a possible qualification of your statement, and I am looking at an article in the current issue of Science called National R&D Policy and Industrial Perspective, by the gentleman who is the senior vice president of GE for research and development, Mr. Schmidt.

He makes essentially the same point that you do, that we—Government should not be involved in targeting industries. It should provide the conditions for it. It should support basic research and focus on university-basic research, as a matter of fact, but he offers one qualification and that is that where the Government is customer, where it creates the market itself by doing the purchasing, it has a vested interest in performing the whole process, and he gives as an example super computers, where he says the Government is the largest customer and that the spinoff will be tremendously valuable to private industry, very large-scale integrated circuits.

He sums it up by saying:

> By meeting its own development needs in those areas where it's the customer, the Government may advance technology that can be used in commercial innovations.

Now, I want to ask if you would concur with Mr. Schmidt in this somewhat of a qualification of the general principle?

Mr. ZSCHAU. Yes, Mr. Brown, I would agree with the qualification. I don't agree with the examples that he used. I feel that in very large-scale integrated circuits in fifth-generation computer, even supercomputer, the requirements and the opportunities that drive development in the private sector are very strong, and I would not use those as examples of where the Government is the sole customer, the primary customer of the technology, but perhaps other examples, such as those related to our national defenses are very—fall into that qualification and I would support it in those areas.

Mr. BROWN. He does suggest that national defense is the overriding area, but I think he feels that these fall within the national defense overall umbrella. He also mentions aircraft and some other things of that sort, but I think our policy question here will be in carefully defining these areas and I sense too many times in discussing this that we agree on very broad principles, but when it gets down to some of the nuances, we get trapped by not understanding the basis on which we really are operating here, and I wanted to get your views on that clarification.

I have no further questions, Mr. Chairman.

Mr. VOLKMER. I recognize the other gentleman from California, Mr. Lowery.

Mr. LOWERY. Ed, I think you've rightfully focused on probably the crux of whether we're going to have a viable commercialization of ELV's and that's the shuttle pricing policy. Have you thought through how you feel that should—should work?

Mr. ZSCHAU. Well, I feel that the shuttle pricing should be based on the full cost, rather than a subsidized cost. One has to get into the details of the numbers to determine what that is, but my sense is that the current shuttle pricing is subsidized relative to the costs of a launch. Perhaps the NASA Administrator can get into more

detail on that, and I think that is the critical element. If there is no opportunity for commerical venture a very small opportunity for a commercial venture to do satellite launches because it's competing at prices that are uneconomic for it and uneconomic for NASA—while there is a subsidy from the taxpayers to the NASA—then I don't think you're going to have the development of the commercial activity to the extent that it could otherwise be done. I also feel that perhaps the focus of the Government, rather than being on the basic research, advancing the frontiers, and creating an extension to the technology base will be made more on operations than on the basic research.

So it seems like you fail in two areas: You don't get the commercial development and you may not get the basic research that you would otherwise get.

Mr. LOWERY. Well, I understand Ariane just cut their price again and I don't see how the shuttle can continue to compete with Ariane on continuing to lower the price. It does strike me, though, that commercial ELV's here could compete with Ariane, realizing the shuttle is a entirely different vehicle.

But even on the pricing policy for shuttle—I mean, how far back would you reach in terms of the R&D costs?

Mr. ZSCHAU. Well, I don't think that I'd go back and try to recapture the basic research and development. That research base is there, not only for NASA, but for others to use and that's the reason why we did it, but certainly, on the——

Mr. LOWERY. Production——

Mr. ZSCHAU [continuing]. Out-of-pocket costs——

Mr. LOWERY [continuing]. Launching costs——

Mr. ZSCHAU [continuing]. Of a launch these days, that's the minimum amount that you would apply to the full-cost pricing.

Mr. LOWERY. Thank you.

Thank you, Mr. Chairman.

Mr. VOLKMER. Now recognize the gentleman from Washington, Mr. Chandler.

Mr. CHANDLER. I would simply like to compliment my classmate and colleague for his very articulate statement. I call to the attention of the members that he has led the group that developed the 14-point agenda called Targeting the Process of Innovation, from which he quoted profusely during his comments, and I think it offers a blueprint for the Congress to look at as we develop technology in the company and not only those emerging industries, but also those that are in decline because of the high costs of all the factors that go into it.

As Mr. Lowery was asking you your views, he really asked the question that I was interested in. I know we're all going to ask Mr. Beggs the same thing. I'm wondering about capability and the ability of the private sector to immediately be able to serve the needs of that private interest out there.

If you go to a full-price system immediately, does it have to be a phase-in? Do we see the French taking advantage of our changing the pricing policy abruptly? What's your view of that?

Mr. ZSCHAU. Mr. Chandler, I don't have the details of where all of the private sector launch vehicle companies are in their development programs and their capabilities, but I'm also aware that—I

am aware that the NASA has made commitments to customers and I think it would be awkward to, having made a commitment, to change at this time. But if one would adopt a policy of promoting, to the greatest extent possible, the commercialization by private companies and then, based on that philosophy, have a transition to a full-cost pricing and a focus on the research, that would seem to make sense—to meet the commitments that have been made and yet, to promote the private commercialization to the extent that—as fast as it can be done.

Mr. CHANDLER. Thank you.

Thank you, Mr. Chairman.

Mr. VOLKMER. I now recognize the gentleman from Texas, Mr. Andrews.

Mr. ANDREWS. Mr. Chairman, I have no questions.

Mr. VOLKMER. We have the gentleman from Florida, Mr. Nelson.

Mr. NELSON. Good afternoon.

Let me follow up on your comment about your opposition to the subsidy of the shuttle. You're aware of the fact that the United States faces the competition from the French with Ariane. You want to make any comments about competitiveness vis-a-vis that commercial market in light of the fact that the French are subsidizing very heavily?

Mr. ZSCHAU. Well, I guess I'd look at it this way, Mr. Nelson: If the French want to pay the bill for U.S. companies to launch satellites, that's their decision to make. I'm not so sure that it's smart for them to do that, but I would not, just because they are doing it, argue that U.S. taxpayers ought to pay the bill for private companies to put satellites into space.

So I would separate the two issues and say that our policy, our NASA policy and our Federal technology policy, should be based on what's best for this country—and the private as well as the public sector, and if the French are bound and determined to pay the bill for launching our satellites, I don't see what we can do about that.

Mr. NELSON. Now, you're talking about basic operational costs; you are not talking about a recovery of research and development costs, are you?

Mr. ZSCHAU. No, I have not been—I think that the R&D that's been done by NASA has been done for all of us, and that's the justification for NASA. I'm a strong supporter of the Space Program.

What I hope will happen is that the focus in the future will be, as it's been in the past, in advancing the research base and the technology and that the more routine—what you might call "space operations," "space business," will be done by the private sector, as it's been done in so many other areas of technology.

Mr. NELSON. Do you have an opinion as to whether or not the Air Force is carrying its fair share in this allocation of appropriate costs that you're speaking of?

Mr. ZSCHAU. No, I don't have an opinion on that.

Mr. NELSON. Your basic opinion, then, your thesis is that don't have any subsidy for operational costs on the shuttle, and thereby, that will allow the emergents more of the expendable launch vehicle.

Mr. ZSCHAU. That's my basic thesis, within the qualifications of timing and transition and commitments and so forth. It would have

been, I think, a detriment to the integrated circuit business if Bell Labs had decided that it was going to come in and offer the lowest-price transistors at the time Bill Shockley was setting up his shop and others. They did not do that—didn't enter the commercial market—and as a result, the private market developed. I think that's the same way that we ought to look at this. What's the proper role of Government? Should it be a competitor or should it enhance the environment for the private sector to exploit this opportunity?

Mr. NELSON. What about in the case where those expendable launch vehicles might be heavily subsidized by the Government in the case of the Air Force with an expanded Titan or Atlas?

Mr. ZSCHAU. Well, it makes it more difficult, obviously. The analysis of the right policy is easiest when all of the costs associated with the business are assumed by the business. But one of the reasons we do basic research is to provide this research base for future enterprises and it's to be done for the benefit of all of the taxpayers—that's why they're paying for it. I don't think it was ever envisioned that we would have a space program in which NASA would be in business, but rather, it's a research arm to do things that wouldn't be done otherwise. We have done some amazing things as a result.

Mr. NELSON. So where you see the development of new technology, such as a shuttle-derived technology, boost vehicle, you don't have any—any problems in your philosophical point of view of the research and——

Mr. ZSCHAU. No, just as——

Mr. NELSON. Development?

Mr. ZSCHAU [continuing]. Indicated that I didn't feel it would be appropriate in full-cost pricing for NASA to put all the R&D in there and then try to write it off, nor do I think it's appropriate to try to assess some cost to the people who are using technology that have come out of the space program in analyzing their cost.

Mr. NELSON. Thank you, and thank you, Mr. Chairman.

Mr. VOLKMER. The gentleman from Virginia, Mr. Bateman.

Mr. BATEMAN. Mr. Chairman, I yield to the gentleman from California if he'll permit me first just to say, as a word of preface, that I'm sorry I missed Mr. Zschau's testimony. The gentleman from California is one of our most knowledgeable members in the area of technology, and as commented by the gentleman from Washington to my right, has made outstanding contributions to, I think, the formulation of sound policies on the part of the Federal Government.

Sorry not to have heard the statement, and not having heard it, sorry that I don't have a copy of it in front of me, either.

Now, I yield to the gentleman from California, Mr. Lowery.

Mr. LOWERY. I appreciate my colleague yielding. I just wanted to follow up on Mr. Nelson's questions.

Where is it appropriate for Government to compete? I mean, at the basic research level, at the applied research level, prototype, proven system? Where does Government beg off and allow the private sector to take over?

Mr. ZSCHAU. It's hard to draw a firm line without looking at the specifics. But my philosophy—and it's really only my philosophy—

others have different philosophies—my philosophy is that the proper role of Government in research is to do that research that would not be done by the private sector.

Certainly, you can describe some examples of where it's obvious, and there are others where it's kind of a borderline case. An obvious example was the research done in colleges and universities with Government funding into DNA, to just try to understand the genetic coding scheme of the body. There wasn't any idea of a product there, but out of it came gene-splicing technology and the genetic engineering business.

A less clear case is the research that's now being done in DARPA on a fifth-generation computer project with a mission related to artificial intelligence, computer applications in a military environment. It's not as clear to me whether that wouldn't be done in the private sector. In fact, there are a number of private-sector companies doing similar type of research, so that is more of a gray area.

But in general, my philosophy is Government-sponsored research should be that which would not otherwise be done in the private sector.

Mr. LOWERY. Should the Government have built the shuttle?

Mr. ZSCHAU. I think so.

Mr. LOWERY. But now that it's a proven system, there are other systems that are additionally proven.

Mr. ZSCHAU. Well, I'm suggesting that the role of the shuttle is not over. I mean, its life, in my opinion, and its value and its contribution are just beginning. The proper use, in my opinion, however, is to get into some of the areas such as the manufacturing of pharmaceuticals in space that can only be done there, the unique things that the expendable launch vehicles can't do.

But the routine job of putting a satellite into orbit that can be done in other ways with what you might call "old technology"—and more efficiently at that with that old technology—should be left to the private sector if the investors and the entrepreneurs, the companies, are willing to do that job.

Mr. LOWERY. Thank you, and I appreciate my colleague yielding.

Mr. VOLKMER. The gentleman from Florida, Mr. MacKay.

Mr. MACKAY. No questions.

Mr. VOLKMER. I'd like to ask—just to get back to the shuttle-pricing policy. Sometimes I find, in discussing this with other Members and individuals concerned, that sometimes we get into a question of use of terms of words and what we actually mean when we're talking about a subsidized shuttle flight for commercial presently or whether we're talking about full costs and what goes into that.

And I would just like to have some idea—you've mentioned that you don't want to recover all the R&D, but have you given sufficient thought to—no, are we going to attempt to recover those things that are still taking place in changes in the shuttle, updating, like Columbia, those things? Are we going to bring that into the pricing policy on a later flight?

Mr. ZSCHAU. Well, if the changes, Mr. Chairman, are being made to pursue other research aims, modifications of that nature to make the shuttle more valuable for this basic research mission that I would focus it on, that's not part of the—the cost—full cost,

but what I would be looking to in a full-cost pricing without getting into the details, is if it costs you—I don't know, $350 million to do a launch and your primary mission is to put, let's say, five satellites into space as an example, then it is costing $70 million bucks apiece per launch. That's the full cost that we're talking about.

Mr. VOLKMER. That's what I'm trying to get at. Are we talking about what some of us called the added costs? In other words, you're not then talking about what it costs to develop and train all the astronauts that are going to be flying them on that shuttle mission. You're not talking about all the R&D that went into testing and proving up those engines and the solid rocket boosters, et cetera. You're talking about the fuel that went into it. Those things that are used up in it—that which is used up—the cost of actually tracking it, et cetera, and getting the data back from that shuttle flight, all those costs, right?

Mr. ZSCHAU. Well, I would have to go through a list of them and the criterion that I would use is——

Mr. VOLKMER. Basically the added cost.

Mr. ZSCHAU. Yes; the criterion I would use is one that's often used in business, where you're trying to price out a product and you say, "If I weren't making this product, what would I be spending, and if I am making the product, what would I be spending?" That involves the people who are associated with that particular activity, as well as the equipment, and the expendables associated with it.

These are very difficult accounting questions even in a little company and even more so in something as complicated as NASA, particularly when it has a number of missions that it's pursuing. So I wouldn't want—I don't feel that I'm qualified to be able to answer your question specifically and say, "These are the things that should be in and these are the things that shouldn't."

Mr. VOLKMER. Right. The same way that the development costs for the Centaur upper stage, which we use basically on Government-type of missions, would not go into development costs on somebody that's going to ride a flight for a communications satellite to geosynchronous orbit.

Mr. ZSCHAU. That's probably true.

Mr. VOLKMER. I mean, it has no commercial—right now, no commercial application—not intended for the commercial application—intended for a governmental-only use.

These are the things that I think some of us really must look at before we say subsidize flights with the shuttle. I think we should analyze it very thoroughly before we come up with that.

The other thing I'd like to mention is—and has been mentioned by the members here—is the Ariane and its subsidization. I don't know if you know, but the—there has been a petition filed with International Trade Commission in regard to their unfair practices by TCI.

Did you know that?

Mr. ZSCHAU. No, I was not aware of that, but if it's based upon—if the charge is based upon subsidy or the French Government's help there, I would think that the same sort of charge might be levied against NASA in the pricing that it offers.

Mr. VOLKMER. Well, before—that's where it gets back to the original—before we say that you can do that, I think we have to first analyze what NASA charges as against what it should charge, and there you have to come down to some decisionmaking as to what is, in fact, utilized as an added cost and what is actually utilized as a development cost or a past research cost.

I have no further questions. I wish to thank you for your testimony here today and appreciate your being here and giving us the ideas that you have in regard to the similarities between the development in the computer industry and the space industry.

Mr. ZSCHAU. Thank you very much, Mr. Chairman.

Mr. VOLKMER. At this time, our next witness will be the Honorable James Beggs, Administrator of NASA.

Mr. Beggs, I want to thank you for being here with us this afternoon and your statement will be made a part of the record in full, but because of its briefness, I am sure you can either review it in full or however you so desire.

STATEMENT OF HON. JAMES M. BEGGS, ADMINISTRATOR, NASA, WASHINGTON, DC

Mr. BEGGS. Thank you, Mr. Chairman——

Mr. VOLKMER. I'm sure there'll be more questions later on.

Mr. BEGGS. I'm sure.

Members of the subcommittee, I'd like to thank you for this opportunity to report on NASA's activities for the commercial use of space.

President Reagan, in his State of the Union Address of January 25, 1984, and in his National Space Policy of July 4, 1982, made the expansion of private investment and involvement in space a major objective of the U.S. Government. The U.S. Congress has endorsed this thrust.

The President's program is designed to encourage private enterprise in space and requires Government and industry to work together to ease regulatory constraints and, with NASA's help, promote the private-sector investment in space. We are actively supporting the president's program with several initiatives for the best use of commercial opportunities in space.

Mr. Chairman, as you have said, we must ensure that the private sector has the freedom to organize and operate for profit in space. We must proceed thoughtfully to establish precedents that will best serve the commercial use of space and the civil space program for many years to come. I believe NASA's role is, in a word, to "facilitate." I trust we shall be as successful as we were in the past with the satellite communications industry, which started as a NASA program and evolved into an extremely successful commercial industry.

Mr. Chairman, this concludes my remarks on NASA's activities for the commercial use of space. I thank you for the opportunity and I'd be happy to respond to questions.

[The prepared statement of Mr. Beggs follows:]

STATEMENT OF JAMES M. BEGGS, ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Mr. Chairman, this concludes my remarks on NASA's activities for the commercial use of space. I thank you for this opportunity and I shall be pleased to respond to your questions.

Mr. VOLKMER. Thank you very much, Mr. Beggs.

We will proceed under the 5-minute rule with the gentleman from California, Mr. Brown.

Mr. BROWN. Mr. Chairman, I would like to defer questions at this point.

Mr. VOLKMER. The gentleman will pass at this time.

The gentleman from California, Mr. Lowery.

Mr. LOWERY. Mr. Beggs, it's good to see you again.

Mr. BEGGS. Thank you, sir.

Mr. LOWERY. I think you're doing a great job down there and I think we've witnessed a revival of the United States in space, particularly man's involvement in space once again.

But with the commercialization aspects, my concerns are this critical shuttle-pricing policies because I see that as the biggest impediment to having a viable, commercial ELV's.

Could you share with us NASA's thinking and what direction you may be headed in?

Mr. BEGGS. Yes, sir, I'd be happy to do that.

The NASA policy on pricing has not changed since we first established our pricing for the shuttle in the midseventies. The way we went about doing that was to look at the market, as any businessman would do, and to estimate the size of the market. Admittedly, our crystal ball in the midseventies in the market for Shuttle services was as cloudy as anybody's crystal ball when it's going into a new product activity. But we sent a mission model up and then we took the best cut we knew how in the midseventies of what our most probable costs were—that is, the direct costs, not the R&D costs, because it has been the policy of the U.S. Government to write off R&D costs at their—at the time you expend that money——

Mr. LOWERY. You are talking production and launch costs?

Mr. BEGGS. I'm talking about—nonrecurring R&D costs, I'm talking about the costs of the research that went into the initial work

on the shuttle, the cost of developing the shuttle and the cost of producing the vehicles. That we wrote off.

Mr. LOWERY. OK.

Mr. BEGGS. And assumed that it would not be recovered over any number of years. In short, it was—it was not dissimilar to the policy that this Government has followed since the origins of the Republican things like waterways, highways and other things. Once the money is expended, it is assumed that it is written off.

So, we assumed that that was written off and that we would recover, however, the direct costs of operating the system over, as I say, a mission model. The mission model is a 12-year model and it was, with the virtue of 20/20 hindsight, overestimated. That is to say, we assumed a market that was significantly larger than it has turned out to be. In fact, we went, as well, 3 years late with the system, which cost us some additional money in escalation and we had priced, of course, for the first 3 years firm to our customers and that meant, perforce, that at least in the first 3 years, because we were 3 years late, that we—there was no way that we were going to be on that curve.

Nevertheless, the philosophy that we adopted held and in setting the price for the second 3 years, we adopted the same philosophy—that is, we took a new look at the market and we set our pricing policy on the basis that we would recover in the second 3 years additive costs over the market projection we had for that period and our objective, and our policy for pricing over the 10-year or 12-year period remains the same. That is, that we will fully recover our costs, fully recover our direct costs over the 10- or 12-year period—first 10- or 12-year period that the shuttle will be in operation.

I must say that in the last 3 years, we've made what I consider to be very good progress against that objective. Our costs are coming down a very steep learning curve and we are finding that in each year, we are underrunning a little bit the cost projections that we have made, and that is very encouraging to me.

Now, I might say, with respect to—to criticism that the Agency has received from a number of quarters, both in this country and abroad, that we priced on what I consider to be a very sound commercial basis, that is, we didn't price the first flight at full cost, nor does any entrepreneur that goes into business. He looks at the market; he makes an estimate of what the market potential is and he prices his product over what he considers to be average costs over several years, hoping that somewhere along the line, he is going to break even. Every commercial aircraft that is built is built on that basis. As far as I know, the Apple Computer Co. did that when they conceived and started executing their business and those businesses turn out to be sometimes very profitable; and; other times, they turn out to be not so profitable. That's the rub of the green, if you will, in the way the market system operates. Sometimes you guess right and sometimes you guess wrong. It could be argued that we guessed wrong.

I would argue that we did guess, to some extent, wrong, but to the large extent, except for that 3-year slip, we are pretty close to being on our plan. Now, are we going to break even before 1988? I doubt it, but I do think that this program has the potential of breaking into the black, that is, of earning a little bit over our ad-

ditive or direct costs, whichever you want to argue, sometime in the 1989 to 1990 time period.

I think if we do, that we will have planned very well, and I think the pricing policy that we have set in those years was soundly conceived.

Mr. LOWERY. Mr. Beggs, with the shuttle—I mean, we're only beginning now to, I think, begin to understand what its potential is. But with regard to ELV's, if it's a national policy to encourage commercialization and if the only game in town is Ariane and they continue to undercut whatever shuttle pricing policy is, how are we, as a matter of national policy, ever going to get our commercial ELV enterprises off the ground?

Mr. BEGGS. This country, for good or bad, is the price leader in the world. We establish the market. It was the—the U.S. pricing of these ELV's which established the level that the world—the umbrella, if you will, that the world operates on and that is at once the—the positive and the negative effect of being the leader in a field. That is, your prices are known and if someone wants to come in and buy into that market, they are entitled to do so.

In a free-market situation, one would hope that if they—that you would continue to improve and be, in addition, to being the price leader, to be also the most efficient producer and, therefore, someone buying in under your prices will find it extremely difficult to operate over the long term.

I think the French will find that. Indeed, if you listen to some of their complaints right now, they are, indeed, reflecting just that. They are hurting. The prices they are charging are far less than their costs and they're hurting and so they're saying: "Why don't you raise your prices to full cost?" and we say to them, as I have said directly to them:

> Look, our pricing policy was clear from the beginning. We announced it. We've told you what we were going to do, that we were going to price over a mission model and that our prices would be set on the basis of that mission model. You decided on your own that you would enter the market on that basis. Now you're saying that we're priced too low.

Now, I would say the same thing to the folks who have come under the ELV market. They knew where we stood. They knew where our prices were. There was no mystery about it and we have not, in our bids to the various people who have asked us for bids, have not changed our policy one iota. We have priced them right out of the book.

Now, what else can we do?

Mr. LOWERY. Do you think commercial ELV businesses are viable at this time in the United States?

Mr. BEGGS. Yes, I do. I do. The agreement that we wrote with the Delta folks, by its definition, allows them to price somewhat below the shuttle prices, and indeed, they did. They have. They have priced below the shuttle prices. They didn't meet the—the trouble is they didn't price down as low as the Ariane people were willing to go.

Mr. LOWERY. I think the chairman has been more than generous with me on time and I thank him.

Thank you, Mr. Beggs.

Mr. VOLKMER. The gentleman from Washington, Mr. Chandler.

Mr. CHANDLER. Thank you, Mr. Chairman.

Mr. Beggs, how long will the current prices that are in effect be in effect?

Mr. BEGGS. For shuttle?

Mr. CHANDLER. Yes.

Mr. BEGGS. Through 1988, through September 30, 1988.

Mr. CHANDLER. Now, is NASA making commitments to companies for launches beyond 1988?

Mr. BEGGS. Not yet. Not yet, but we are being pressed to do so.

Mr. CHANDLER. At what point will you, then, make a decision on the pricing——

Mr. BEGGS. Well, I think sometime——

Mr. CHANDLER [continuing]. Policy behind it?

Mr. BEGGS [continuing]. In the next 6 to 9 months, we're going to have to because most of our customers require a commitment that far in advance, that is, say, they have to make their plans at least 3 to 4 years in advance or they simply, you know, can't count on getting on orbit when they want to get on orbit. So, we're going to have to come to grips with that and we will have to—what I am trying to do is get as much cost experience as we can get before we have to make that decision. Every time we fly, we're getting a little more experience in understanding where our costs are. And we are flying quite a lot these days, as you have probably noticed.

We'll be flying next week and then we'll fly 3 times more this year and then next year, it looks like we'll fly 11 times, though we've had some troubles this year with upper stages which have caused us a little setback, but we're going to get over that. And so I would like to get as much under our belt of that experience as we can and then we'll be in a better position to price to what people want us to price and that is, our full, direct costs.

But when we reach that pricing decision, we have got to take into account what I said previously, and that is, our policy was set that we would break even over—over a period, not just over a few years.

Mr. CHANDLER. But break even without the cost of the production of the shuttle——

Mr. BEGGS. Without the nonrecurring costs, yes, sir. Without taking into account—and I might say, there is no argument on the—there is no attempt on the part of any of the ELV's to—nor have we suggested that they should pay any part of the nonrecurring costs of the creation of the ELV's. And, indeed, the Ariane people are not trying to recover any of their nonrecurring costs, so that's a given across the board.

It's not argued that anyone should recover the nonrecurring costs. What is argued is whether you're recovering fully the direct costs of operation.

Mr. CHANDLER. Well, I have no further questions at this time, Mr. Chairman, thank you.

Mr. VOLKMER. The gentleman from Florida, Mr. Nelson.

Mr. NELSON. Mr. Chairman, thank you.

Good afternoon. You're doing a terrific job and it's also an exciting time for you to be as the head of this agency because of the tremendously important decisions that you're making, that we're making about the future of America in space and particularly

about the subject of today, the—as we sit here and forecast as to literally the explosion of commercial activity that will take place in the future in space, and I think it's very exciting.

I would like your comments for the record as to what you think the possibilities of being in the black sometime after 1988, to use your words, to breaking into the black—how they might be dim. In addition if there is the possibility that the Air Force were to continue on with developing an additional 10 ELV's and taking those payloads off the shuttle starting in 1988, over 5 years?

Mr. BEGGS. Mr. Nelson, let me—let me address the last part of your question first. I think the most serious threat we have to the shuttle is losing the military payloads. Initially, we envisioned that the military would use a third of our capacity. It was envisioned that it would be one-third the Department of Defense, roughly a third commercial, or perhaps a little more than a third commercial, and the rest would be NASA and other Government uses. And by commercial, I include the foreign market in that.

The loss of a significant part of the military market would hurt us because this system is peculiarly—well, maybe not peculiarly, but it is—it is—as many systems, uniquely sensitive to flight rate. The larger number of times you fly, the more you can spread, what is in essence, a fixed cost. The standing army that we have at Kennedy and will soon have out at Vandenberg and the cost simply of keeping your facility up to—to full operational capability so that you don't have problems. You don't have accidents or other serious problems.

So, the degree we can increase the flight rate—and as you well know, we had originally projected we would build up to flight rates of 30 or 40. Indeed, we were supposed to be somewhere close to 30 already in our flight rate and, as you know, we're looking at 11 next year.

So we have significantly cut back on the flight rate that we had originally projected and that very significantly affects our costs. To the degree that the Department of Defense decides to go fly any of their payloads on expendables and does not fly on the shuttle, it will have a detrimental effect on our costs. So, it's serious.

Now, let me hasten to add the DOD so far has not said they're going to do that. Quite the contrary. They've said that they still consider the shuttle to be their primary system, their primary means of getting into space, and I have to take them at their word on that, that they will. What they are referring to is "a backup," and I cannot gainsay their need for a backup if for national defense purposes they require that there be a standby capability to ensure that they have access to space, then certainly they should have it, but I would hope that if they do that, they will still count on the shuttle to carry the bulk of their payloads.

Up until now, we have flown—we have yet to fly our first DOD payload. That's through no fault of ours and no fault of the DOD. There were unfortunate situations that have prevented that from happening. We will fly the first one sometime this fall and I hope that we will then start a process of seeing a routine use of the shuttle by the DOD.

The shuttle offers some unique capability, not the least of which is an ability to repair, which we demonstrated just a few months

ago. And I think that once they get to use the shuttle, they will find a lot to like about it.

Now, to address the other part of your question, the commercial market—and I must say, the market that we intended to—to serve in both the U.S. Government and NASA itself has not been as large or has not reached the flight rate that we would have liked.

Now, we're beginning to get there, and I think if we stick with it, that by 1988 or 1989, we will be able to see this system at a point where we can turn it over to either—either a quasi-private or Government organization or to potentially a private operator and have him operate it either for profit or operate it on a basis where he could make a little money on it.

I think that potential is there and I think the cost curves that we've looked at over the last 3 years give us great encouragement in that. But we—until about 1988, we still have some development work to finish in addition, and we must do that. We must get this system to full operational capability and that means that we have about two or three nagging problems that are still with us which admittedly we probably should have had under our belt by this time, but we still have some problems on the main engines which are well in hand. We know how to solve those problems, but it's going to take a little more time.

We still have a few problems in some of the critical subsystems on board, which we also have well in hand, and we do have—still have some things that we have to demonstrate to reach full operational capability.

Mr. NELSON. Mr. Chairman, in my concluding comments, I would only interject that unless you are aware of something that has happened recently, I was under the impression that the Air Force had studiously avoided using the word "backup," but rather had used the word "complementary" or "supplementary," that their system that they were asking for was not a backup, but rather it was a supplement to the shuttle, and that's what so many of us have had difficulty with when, in fact, the shuttle was supposed to be "the" space transportation system.

Do you have a comment on that?

Mr. BEGGS. All the letters they've written to me refer to the shuttle as the prime—primary means of access to space. They have not changed that and, as you well know, that's the President's policy. That was part of the policy that was announced in 1982, on July 4, 1982, and they have stuck by that.

I have heard—I have heard both terms used. I regret the use of the term "complementary." I think it's—that if that is their intent, that would worry me a great deal, and I have made that known to them that it worries me if they're looking for a "complementary" activity, because that—that assumes—or at least implies—that they would—they would choose between one or the other at any given time.

And the trouble with that is simply that it's a catch 22 for NASA because in any given year, the price that we will charge the Air Force is fixed, whereas in any given year, if you fly one or two or three more expendables, you can spread those fixed costs over a larger number of flights and so reduce your cost without it costing you a nickel to cancel the flights off the shuttle, so that's what

worries me about when they start talking about complementary or supplementary.

Mr. NELSON. Mr. Chairman, I know my time is over and I just want to throw this question out and if you get a chance to work it in in any of your other answers, please do so, Mr. Beggs, but I would be most interested in your thoughts as to making the shuttle economically viable, thus the subject of our discussion here today, commercialization, and how development for that backup, nonmanned system might help you achieve that goal if it were from shuttle-derived technology to be an unmanned system.

Mr. BEGGS. Yes, sir——

Mr. NELSON. Thank you, Mr. Chairman.

Mr. BEGGS [continuing]. I'd be happy to do that.

Mr. VOLKMER. The gentleman from Virginia, Mr. Bateman.

Mr. BATEMAN. Mr. Chairman, I'd just like to join in welcoming Mr. Beggs back before the committee. It's always a pleasure to have him, to compliment him for the job being done by him and his associates at NASA, and to ask only one question, and that is, whether Mr. Beggs, you feel there's any particular legislation that needs to be pursued or enacted that would further the commercialization of space in a manner which serves the public interest? Or is the legislative fabric that's necessary in place?

Mr. BEGGS. I think what we have in the Space Act gives ample room to do what we need to do in the commercialization area. This committee, I should say, and I should compliment the committee, has been very forthcoming in making a record which makes commercialization relatively easy. I refer, of course, to the policies that we've initiated over the past several years to—which allow us to go forward with joint endeavor agreements with the industry and in those Joint Endeavor Agreements, to enter into a—if you will, a cost-sharing kind of arrangement with them where we fly their payloads for free while they're in the research and development phase. And then, of course, if they reach commercialization, they pay their way. The committee has endorsed that concept and it's been very helpful thus far and we need to expand our activities.

In summation, though, Mr. Bateman, I see no need for any further legislation. I think there is ample authority to do those things.

Mr. VOLKMER. The gentleman from Pennsylvania, Mr. Walker.

Mr. WALKER. Thank you, Mr. Chairman, and let me, too, welcome you before the committee. We always appreciate your visits with us.

Let me ask you a rather general question with regard to NASA's view of space commercialization. Do you see the role of NASA as developing a basically industrial policy with regard to space, where basically the agency helps picks the winners and the losers in space, or do you see NASA's role as primarily assuring that a free investment climate exists that allows those who want to move into space investment have relatively few barriers to do so?

Mr. BEGGS. Mr. Walker, I see NASA's role in about three different areas. One is to do the basic research work that opens up the opportunities. Most of what we are—what we see interest in right now relates primarily to what is generally referred to under the term "microgravity research," and we are doing quite a lot of that. Maybe not as much as some would like, but we are putting signifi-

cant sums of money—we will put about $25 million in this year and probably a little more over the next—each of the next 2 years.

That basic research is intended to start to open up various opportunities and I should point out that the one or two near-term commercialization opportunities are things that were opened up by our microgravity research in the past, namely the electrophoresis experiment. The basic work on that was done back in the Skylab days and what is known as the monodispersed latex experiment, which will be put on the market by the Bureau of Standards here very shortly and I expect as soon as it goes on the market in a few years, we are going to see some entrepreneur come in and figure out a better way of doing that because those—it turns out there's a very big market there for those little bitty—"monodispersed" means exactly the same, spheres that have a uniform size, and that research was done several years ago.

It gives you some idea of how long it takes. You know, we flew the Skylab back in the early 1970's–1974, I believe—and it's taken 10 years to bring the electrophoresis experiment on to the point where it now looks commercially practical. And the latex experiment's been in the works for 6 or 7 years as well. So we ought to do that.

Second, we ought to make available to the industry, both the facilities that the Government has, both in our research centers, where we have the great national facilities that make possible research that individuals or even large companies cannot afford to duplicate, to make those available to them and to make available to them the talent in NASA to help them do whatever it is they want to do; and thirdly, to make available the shuttle on a relatively simple and easy basis.

I must say that we're a little bit derelict in the latter. We have made it somewhat more difficult than I think is really necessary for people to get on board the shuttle, but we're trying to ease that process day by day and I think it is getting easier.

So that when someone comes up with a bright idea, whether he comes from a university or from a private enterprise, that he can get on board the shuttle and prove out his idea. But I don't think we ought to try to pick and choose between them. Quite the contrary, if we think it's a dumb idea and they've got money to spend on it, and they're willing to put capital at risk, then I think we ought to say, "If you want to try it, be our guest."

Mr. WALKER. Well, and it seems to me that it encompasses—I appreciate your defining that—and it seems to me that it encompasses some other things, too. For instance, as you know, we talked in this committee and eventually adopted some commercialization language for the Organic Space Act that was intended to move the Organic Space Act toward more commercial activity, but now there are some people down at NASA that I've understood recently are interpreting that language as mandating a NASA commercialization role, and I would say that it doesn't—that was not my intent when I drafted original language. I don't think that was the intent of the committee that, instead, what we clearly meant was for NASA to be sensitive to that need to spin off the R&D that you're talking about into the commercial sector as soon as possible and some of us are beginning to fear that NASA will end up with

budget priorities that are oriented more to day-to-day operational kinds of things than they are toward the far-reached developmental activities.

I appreciate your statement because I think what you're saying is that NASA's role has to be developmental in nature and I think we've got to be careful of that. I guess—I guess in summation, my question is: When's NASA going to be ready not just to talk about pricing policies on this shuttle; when are you going to start being able to talk about selling off the shuttle fleet?

Mr. BEGGS. I think that we—that probably it's going to be another 2 years, maybe a little bit longer, but sometime in late 1986, that we can start to examine—assuming again that we continue to progress as we have progressed in the last 3 years since we started flying—that we ought to be able to start talking about—to the committee—various options.

We have had some interest, interestingly, to me, on the part of the private sector to talking about making an investment, anticipating that date; and that encourages me. As a matter of fact, that's the most encouraging thing that's happened in the last couple of years is that there are people that seemingly are willing to come in and put capital at risk to start anticipating the day when this will turn into a private operation.

And I think in 2 years' time, that we ought to be ready to start—at least to come to the committee with a proposition to either sell it off or probably, more likely, give it away, and have an opportunity for getting a competitive organization set up to do that.

Mr. WALKER. Thank you, Mr. Chairman.

Mr. VOLKMER. Thank you, Mr. Beggs.

I'd like to steer the questions just a little bit different area. Last year in response to the President's National space policy, NASA established a task force to develop an agency policy and program plan to encourage and stimulate free enterprise in space. The task force report has been completed, as I understand, but the administration has not publicly released the report at this time.

Can you tell me why this report has not been released by the NASA space commercialization task force?

Mr. BEGGS. Yes, sir, Mr. Chairman. Basically because we still have disagreements within the agency as to how it ought to be properly implemented and I guess we have not, in the press of business, boiled that all down to a consensus as to what we ought to do.

There's no secret as to what the task force report says, however. It says basically that we should begin now to encourage commercial activities in space and I believe we have begun to do that. It did point out that there are some—some bureaucratic and even agency barriers that are inhibiting to commercial use. In particular, the use of the NASA facilities and the NASA expertise and it further said that if we make a firm commitment with the interest that is out there in the marketplace, that we—the feeling is we can develop a good solid partnership and move forward more rapidly than we have in the past.

This will require that we establish—in effect, reach out—that we establish both a mechanism and an environment, an ambiance in the Agency so that we encourage the nonaerospace industry to come in and work with us.

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And I—we're not—we don't do that as well as I think we can, but I can assure you of this: All of the NASA folk out in the centers are dedicated to it. They're trying. They have their own problems in that the majority of the people in the centers are, of course, devoted to the program they're conducting and there are only so many hours in the day, but they are dedicated to improving the way in which the industry can get support.

Mr. VOLKMER. When do you anticipate to be able to iron out the differences and have the report——

Mr. BEGGS. Well, too much——

Mr. VOLKMER [continuing].—Formally issued?

Mr. BEGGS. Too much time has already passed, Mr. Chairman. I think——

Mr. VOLKMER. Could we have it before the end——

Mr. BEGGS. I think we're very close right now. I'm being pushed by a lot of different folks, including the folks over in the White House, to get on with this and—as well as this committee—and I'll get on with it before the summer is out.

Mr. VOLKMER. Well, that's fine.

Now, at that time, of course, the White House has had their own study made. I guess we'll be able to compare the two when we finally get a finalized version. Is that correct?

Mr. BEGGS. That's correct, sir. They have a task group in the Cabinet Council——

Mr. VOLKMER. Yes.

Mr. BEGGS [continuing]. System working this problem.

Mr. VOLKMER. And when—do you have any idea when it will announce its policy on space commercialization and what role, then, would NASA assume in the total effort under that?

Mr. BEGGS. I have no idea when they will get around to announcing their policy, Mr. Chairman. We participated in that, but they are involved in the examination of a number of different aspects of this problem.

NASA will continue, however, under any of the scenarios that have been developed to be the lead Agency in this activity, and I think—you know, we simply have to because we control the facilities that will be needed to do the job, but—and that's recognized—but there is a good deal of interest in DOT and also the Department of Commerce as to what role they might play.

Mr. VOLKMER. Now, how do your space—NASA's space commercialization plans and your progress on working those up relate to those under way that we presently have, like over in the Department of Transportation and also, to some extent, in the Department of Commerce?

Mr. BEGGS. Well, if I may address the last part first, our relationship and activities with Commerce have been very cordial and I think that their traditional role of encouraging and developing new commercial opportunities is one that complements what NASA does. We've got a good working relationship with Commerce.

We are beginning to develop a relationship with the DOT's office, which is dedicated to the question of how they encourage the ELV industry in the United States. That one becomes a little more difficult simply because it's a brand new commercial opportunity and

it's a brand new industry and it is—the policies to encourage them are not clear.

There have been comments from DOT on our pricing policy. I think we've heard from them, as we have from others, as to the way we ought to adjust our pricing for the future. And there have also been comments as to how we ought to charge for the services that we render.

Suffice it to say that I believe that our policy of charging purely additive costs for the services that we render to ELV operators is one that is consistent with past policies in operators of various types of systems who use our facilities.

Mr. VOLKMER. I think it is this committee's feeling, at least a majority of it, that the policies on determining charges on the shuttle should remain with NASA and that's where I think it should.

Mr. BEGGS. Yes, sir, I agree with that.

Mr. VOLKMER. And now what steps are under way—or have we got that far yet—to establish a Commercial Space Program Office within NASA?

Mr. BEGGS. We have been looking at the various parts of the Agency which have been concerned with this commercialization and there are a number of them. There are some in the program offices; there are also some within the staff groups within the headquarters organization, and we have drawn a plan to consolidate several of those activities into a single office. I think we're at the point where we can pull together the resources of the Agency that apply to this.

That will not come without some pain because it does involve some rather comprehensive reorganization. Things like the technology utilization activities and the activities that we've had in working the—the issues with the industry on the use of the shuttle, but I think we're—we're close to having those resolved and I think we'll put that to bed fairly shortly.

I worry a little bit there as I expressed last year on—which is the control issue, Mr. Chairman, and we'll have to worry that as we figure out the appropriate place within the organization.

Mr. VOLKMER. That's what I say. The gentleman from Pennsylvania's expressed, you know, his feeling as to what commercialization should be and I think what we're looking at when we urge the creation of this type of office was basically for the transfer of that technology, et cetera, and the movement from NASA of those areas in which development had been completed to the private industry for those things that could be commercialized basically.

Mr. BEGGS. Well, you know, this is not an either/or situation. It's generally a new idea that comes out of basic research. It is something that's an iterative process—that is, it requires both the researchers who have done the work, as well as someone who comes along with a bright idea as to how to apply that work to work together and it's not a question, I think, of NASA getting into the business of business related to its research, rather than the question of our being avaiable and being willing to reiterate with these people the necessary steps to take them from where we are in basic work to some kind of commercial reality.

Mr. VOLKMER. Yes. Thank you.

Now, in the February 20, 1984, issue of Business Week—and we did have some testimony, I believe, on this, it was reported that NASA is considering establishing space commercialization centers of excellence at a number of universities. What will be the functions of these centers? Can you elaborate on your current plans on establishing those?

Mr. BEGGS. We have—of course, the way in which this country has operated in the past has been that our great universities have been focal points of industrial development. Congressman Zschau referred to one of those activities which—development of Silicon Valley and it really came out of the fact that you had a very bright and active community at Stanford working very hard in the solid-state field and in the computer field and the result of that was that you had a very excellent relationship between the industry and the university and, indeed, very high mobility. Professors could work part time in the industry and the professors would sometimes leave the university and go into the industry for periods of time and help them develop the new businesses.

It's that kind of thing that I think we have in mind—that is, to take some of these areas and develop maybe four or five or even six centers within the university which would be looking at specific types of research where the industry could come and consult, where they could come and take courses and learn, and indeed, where they could draw talent from them in terms of graduate students and even the faculty themselves that we have in mind.

We don't have in mind spending a great deal of money, however. I think a matter of perhaps $5- or $6 million a year for this program should be sufficient to attract some money, both from the universities themselves and from the private sector. That's what we have in mind and we are at the point of starting to look at how we put that kind of money together, which, as you know, is always the toughest part, to figure out where you get $5 or $6 million this year.

Mr. VOLKMER. Now, could you comment on NASA's views regarding the difference between privatization of things—of technology, et cetera, and commercialization? In your view, should NASA treat these two types of ventures differently? And would you like to have——

Mr. BEGGS. I think so. We've tried to discriminate between those two things. Sometimes the lines get a little blurred, but commercialization, we look at as being an entrepreneurial activity where someone is willing to come along, and on his own, put money at risk to develop a new product or service which creates an important new economic activity, something that's good for the country or good for the balance of trade or good for—for employment or what have you.

That, to me, is the good side of what we're trying to do and we call that—we address that by the name "commercialization," and we have a lot of examples of that. But it—it really requires two things: One is money at risk and the other is good economic activity. Obviously we don't want somebody putting money at risk to grow marijuana in space, but if they've got a good idea that is contributory to the good economic activity in this country, we're going to try to encourage it.

Privatization, on the other hand, is taking something that already exists within the Government, such as the shuttle, and making it private. That's not altogether bad—in fact, it's not bad at all, and we encourage it where it's possible, but it's not really where our major thrust is. What we're trying to do is create something new and so we believe the privatization can be good where it takes an operational responsibility and puts it where it ought to be—that is, somebody who can be devoted to operating and can operate it for the lowest cost and in the most efficient manner, but it is not generating something that is brand new.

Mr. VOLKMER. Thank you very much. I have no further questions.

Does the gentleman from California have any questions?

Thank you very much for being here, Mr. Beggs.

Mr. BEGGS. Thank you, sir.

Mr. VOLKMER. And I have about four more questions I'll submit in writing and I'd appreciate if you respond to them——

Mr. BEGGS. Yes, sir.

Mr. VOLKMER [continuing]. We'll keep the record open for about 2 weeks for the response for those questions.

Thank you very much.

Mr. BEGGS. Thank you, sir.

[The questions for Mr. Beggs follow:]

Questions submitted for the record by Chairman Volkmer.

QUESTION 1:

What policies and actions should the Government and NASA undertake to reduce the financial, institutional and technical risks of commercial space ventures and why?

ANSWER 1:

The NASA Commercialization Task Force recommended that initiatives, within NASA's charter, be undertaken in five major areas to reduce financial, institutional, and technical risks of commercial space ventures.

- o Research and Development Initiatives Directed Toward Commercial Opportunities
- o Improve Access to NASA Facilities and Equipment
- o Procedural Initiatives to Ease Access of Commercial Firms to Space Endeavors
- o Organizational Initiatives Focus Commercial Space Responsibilities
- o Outreach Initiatives to Increase Information Flow and Communications

These initiatives are designed to stimulate the private sector's investment in research and development of new, commercially oriented space technology. In order to do this, there is a need to facilitate the high-technology entrepreneur's efforts in the early definition of a commercial enterprise. Industry participation can also be increased by broadening the awareness of commercial space opportunities beyond the aerospace community.

Compared to similar ventures on earth, space-based ventures tend to be more expensive, have longer payback times, and a limited history on which to base risk analysis. Such risks will inhibit development or result in selection of only those space projects with low downside risk. To facilitate increased industrial involvement in basic research and development of new space technologies with significant potential to capture commercial high-tech markets, the Government should work to establish a dynamic partnership between itself, industry, and universities.

QUESTION 2:

The Committee issued a report on space commercialization in October 1983 which recommended that NASA establish a high-level office on space commercialization reporting directly to the NASA Administrator.

o What actions has NASA taken to implement the recommendations of the Committee's report on space commercialization?

o What steps are underway to establish a Commercial Space Program Office within NASA? What functions will it perform and how will it be organized?

ANSWER 2:

To fully understand the context of this question, it would be helpful to review some of the Subcommittee's conclusions and recommendations which follow:

Background

Subcommittee's Report Conclusion Two: "There is no clearly defined need for new legislative authority in order to proceed with space commercialization ventures. However, legislation that defines the responsibilities and authority of a lead agency and provides direction for both Government and industry would be very helpful.

Subcommittee's Report Recommendation: Subcommittee shall review H.R. 1011, "The Space Commerce Act," incorporate suggestions and amend as appropriate.

Subcommittee's Report Conclusion Three: "When providing services or transferring property to the private sector, the Government should not attempt to recoup its total investment costs. The value of the assets associated with ELV launches depends upon their commercial value, and perhaps the income they generate. Therefore, it seems appropriate for the private sector to pay a fee for use of Government assets utilized in ELV launches commensurate with the prevailing market value of those assets."

Subcommittee's Report Recommendation: Government assets should be valued as follows:

a. Inventories should be valued at their prevailing market value.

b. Tooling and test equipment should be based on market value taking into account acquisition costs and depreciation.

c. Services should be priced to recoup costs incurred beyond those normally realized from Government operations which result from making Government services and facilities available to the private sector.

Subcommittee's Report Conclusion Four: "A space commercialization office is needed within NASA's organizational structure to provide a focal point in communicating space technological information to non-aerospace firms and in facilitating space commercialization activities."

Subcommittee's Report Recommendation: "NASA should establish a commercialization office reporting to the Administrator with the authority and direction necessary to ensure effective facilitation of space commercialization activities."

The following addresses the specific issues raised in the question:

a. Sufficient authority to proceed currently exists under NASA's charter, but NASA is examining changes that may be useful.

b. The answer is not simple and depends primarily on the nature of the asset itself. NASA is primarily using the guidelines provided by NSDD-94.

c. We are proceeding to establish a Commercial Space Office to serve as the focal point in the Agency for commercial endeavors. This office will build upon the work that is currently underway.

This office shall provide the focus for initiatives from the private sector, particularly new commercial high-technology space ventures, new commercial applications of existing space technologies. It will support unsubsidized privatization initiatives aimed at transferring existing space programs to the private sector.

It will focus on the evolution of appropriate roles for joint participation of Government and the private sector, with other agencies of the Government and academia.

The office shall support national initiatives, having the authority and direction in NASA to ensure effective facilitation of commercial space endeavors.

It will pay particular attention to management and institutional issues, such as those identified in the Subcommittee Report.

It will also have the job of managing policy formulation and evaluating commercial space matters as well as developing implementation guidelines throughout our Agency.

QUESTION 3:

Will legislation be necessary to achieve the goal for space commercialization and, if so, what should it provide and why?

ANSWER 3:

Sufficient authority to proceed currently exists under NASA's charter, but NASA is examining changes that may be useful.

QUESTION 4:

NASA has entered into agreement with Transpace Carriers, Inc. (TCI) to transfer the Delta program to TCI which will operate the program on a commercial basis. The Committee has written NASA endorsing the agreement and urging that it be implemented by the Agency in a manner that will maximize the venture's chances for success.

o What is the current status of the Delta transfer to TCI and what is NASA doing to ensure the success of this commercial venture?

o In the NASA/TCI agreement, NASA states that it will conduct launches for TCI contracted customers in the event TCI is unable to conduct the launches.

- Under what terms will NASA provide this guaranteed launch backup to TCI?

- How much will NASA charge a TCI contracted customer for a launch performed by NASA?

(The Committee has urged NASA to charge an additive fee, that is, the cost incurred by NASA above budgeted expenditure as a result of a launch on behalf of TCI. NOAA is paying NASA for two Delta launches of the GOES-G and -H weather satellites. A third and fourth launch for TCI would cost less than the usual fee charged for a Delta launch.)

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Is NASA considering a deferred or incremental payment schedule for the purchase of Delta hardware whereby TCI would pay a lower price for initial hardware and a higher price for subsequent hardware?

(Deferred payment would result in more working capital for TCI in the initial stages of their venture and improve chances of securring financial backing, thereby increasing TCI's probability for success.)

ANSWER 4:

NASA has entered into a preliminary agreement with Transpace Carriers, Inc. (TCI) to establish the marketing of launch services on a commercial basis and to initiate the production of launch vehicles in support of the commercial Delta program. TCI has been marketing potential customers who may have needs for launch support services; but, we understand that no customers, as of this time, have contracted with TCI for such services. NASA has no responsibility to ensure the success of TCI, but is cooperating with TCI to facilitate commercialization in compliance with the provisions of National Security Decision Directive No. 94, dated May 16, 1983.

In NASA's preliminary agreement with TCI, NASA has agreed to prepare to conduct launches marketed by TCI if TCI is not capable of performing such launches, provided such launches occur no later than 1986 when the final Government launch is completed for GOES-H and NASA's launch capability is phased out. TCI or its customers shall be liable for all launch costs incurred by NASA up to a negotiated price. NASA will not be responsible or held liable for the success of any launchings performed by TCI, or its customers, but will use its best effort to ensure successful launches.

Since NASA plans to phase out its Delta capability after the GOES-H launch, planned for August 1986, NASA has guaranteed to support TCI contracted launchings until that time. TCI is required to reimburse NASA for costs incurred by NASA in connection with TCI's use of NASA controlled production equipment, special test equipment, special tooling in production of Delta vehicles, costs incurred for space flight hardware made available to TCI, and the cost of other NASA provided services required to support the TCI contracted launchings, such costs would not otherwise be incurred by NASA and, therefore, would be properly chargeable to TCI.

The estimated cost that NASA would charge TCI customers for a launch performed by NASA is approximately $25.0

million plus USAF range charges which are estimated to be $1.0 million.

NASA and TCI have not negotiated a payment schedule for the purchase of Delta hardware by TCI from NASA. Consistent with the terms of the preliminary agreement between NASA and TCI, such payments would be made prior to launch on a schedule to be agreed upon.

QUESTION 5:

Private companies are developing upper stages for sale on a commercial basis - like Orbital Science Corporations's (OSC) TOS upper stage. The Government is also developing upper stages such as the Centaur and IUS.

o In NASA's FY 1985 budget, funding is allocated for integrating the TDRSS with the Centaur for deployment of downstream TDRSS satellites. Does this action mean that NASA has decided not to use a commercial upper stage for TDRSS?

o How will NASA make decisions on selection of upper stages for Government payloads? (That is, sole source vs. competitive bidding.)

o If NASA uses a competitive approach to select upper stages, will NASA give additional credit in the evaluation process to upper stages that are commercially developed and innovative?

o What is the cost difference between using a Government-developed upper stage and a commercial upper stage?

ANSWER 5:

NASA's FY 1985 budget planning identifies Centaur as the vehicle system to be used for deployment of downstream TDRSS satellites. Since the FY 1985 budget submission to Congress in January 1984, other alternative systems such as the TOS upper stage have evolved and will be considered for TDRSS and for other satellite requirements through competitive methods. NASA is committed to obtaining the maximum competition practicable.

The method of selecting upper stages for Government payloads has and will depend on many factors such as: availability to meet the schedule; performance and reliability; cost; and ability to integrate with the payload.

NASA has not established any special policy ground rules for selecting upper stages which gives additional credit to commercially developed upper stages. Appropriate aquisition methods will be utilized in the process of making upper stage selections. Since successful commercial upper stage development and marketing of services will relieve Government efforts and permit resources to be channeled to other worthy endeavors, we have encouraged commercial development of upper stages. NASA will compare the cost difference between using a Government developed upper stage and a commercial upper stage using the cost comparison procedures set forth in OMB Circular A76.

We intend to continue our efforts to encourage the commercial development of upper stages and other space related developments and to use these products where they can fulfill our requirements most effectively.

QUESTION 6:

Many observers have expressed the opinion that there will be a great increase in demand for access to space in the coming five to ten years by commercial payloads of various descriptions, especially many new applications technologies that are only ideas today. What would be the effect on the growth of this new demand of a large (50-100 percent) increase in the post-1988 STS price?

ANSWER 6:

The question of Shuttle pricing is not simple and NASA is involved in examining all of the factors at this time which will be addressed in our post-1988 STS pricing policy. This study should be complete within 6-8 months.

It is too soon to know quantitatively the price elasticity of the space transportation market and, therefore, it would be difficult to assess the impact of such an increase. We believe that we must proceed prudently and cautiously in resolving the question of Shuttle pricing, giving full consideration to: (1) the impact on private sector ELV's, including commercial upper stages which use the Shuttle, (2) the impact on the international competitive posture of U.S. launch systems, (3) the impact on other high-tech commercial initiatives, and (4) impacts on the program budget (i.e., taxpayer).

QUESTION 7:

What do you feel is the best strategy for the United States in its competition with Ariane? Does NASA need

to augment the current STS capability to compete with Ariane IV (larger than PAM category payloads) for commercial payloads?

ANSWER 7:

NASA's strategy for meeting the needs of users is outlined in its Marketing Plan, which has previously been submitted to you. The current capacity of the Shuttle is such that it does not have to be increased to compete with Ariane IV for commercial payloads, in the near term (the next five years).

QUESTION 8:

How do we get from today's rate of private investment to the much higher rate required for significant private-sector involvement in the Space Station? Is there specific action that NASA or the Congress should consider to encourage this type of investment?

ANSWER 8:

One of the initial objectives of the Space Station Office is to review methods of increasing private sector involvement in the Space Station. This includes the present Space Station outreach program, which includes Coopers & Lybrand and Booz, Allen & Hamilton briefings to the venture capitalists, investment bankers, etc., as well as specific targeting of industries and companies with potential interest in Space Station activities.

Mr. VOLKMER. Our next witnesses will be a panel: Dr. John Townsend, Jr., of Fairchild Space Co., president; and Mr. Richard L. Kline, director of shuttle applications/space station programs of Grumman Aerospace Corp.; and Mr. Robert H. Hood, Jr., vice president, McDonnell Douglas Aeronautics Co.-East.

Before we proceed, we have been requested to permit photographs to be taken so I ask unanimous consent that photographs be permitted to be taken. Without objection, it will be so ordered.

At this time, the statements that you all have submitted will be made a part of the record in verbatim and you may either review your statement in full or summarize, however you so desire.

We'll begin with Mr. Townsend, and we'll follow with Mr. Kline, and Mr. Hood, and then we'll go to questions.

Dr. Townsend.

STATEMENTS OF JOHN TOWNSEND, JR., PRESIDENT, FAIRCHILD SPACE CO.; RICHARD L. KLINE, DIRECTOR, SHUTTLE APPLICATIONS/SPACE STATION PROGRAMS, GRUMMAN AEROSPACE CORP.; AND ROBERT H. HOOD, JR., VICE PRESIDENT, McDONNELL DOUGLAS ASTRONAUTICS CO.-EAST

Mr. TOWNSEND. Thank you, Mr. Chairman. I'll summarize very briefly.

I make the point in my written testimony that in my view, there are three keys to achieving our commercial objectives in space. First, I believe that NASA's program of support for commercial ventures in their initial phases should be strengthened and streamlined. Second, I think we should actively work toward making the shuttle a flexible transportation system, optimized toward taking full advantage of its unique capabilities at the lowest user cost.

Third, I believe the Government should correct a number of tax, legal, and regulatory barriers to commercial activities in space. Given what has been said earlier this afternoon, I'd like to address the issue of the ELV pricing myself a little bit, because I take a somewhat different view on this subject and I'm sure my friend from McDonnell Douglas will also take much the same view.

Our particular programs, projects in space, and they are commercialization, require the shuttle. The shuttle is absolutely essential. They are risky projects. They are long-term projects, in our case on the order of 3 years just to begin, and uncertainties in the Shuttle pricing would increase the risk and our ability to finance those programs substantially.

We feel that those prices should be kept low and we feel they should be very predictable. It would be very upsetting to get downstream in these programs and suddenly find the cost doubling, which it might, depending upon how you accounted for the cost.

I also would view—and I do view with some alarm, the military's interest in a heavy-lift launcher as certainly competitive with the shuttle, and to the extent that the ELV people take away payloads, I'm worried that the cost to those of us who require the shuttle is going to go sky-high. So there is another side to this pricing coin, and it's a serious side, and I think it is going to require a good deal of study, both how the accounting should be done and then, second, what our policy is, and it may be that we wish to consider a double-

tier pricing of some sort, recognizing that some ventures require the shuttle and recognizing on the other hand that some ventures may not be viable if the shuttle is considerably underpriced.

Mr. Chairman, I think I will end here at the moment. I'd be glad to answer questions. I think you have already introduced the subject that there has been a task group working with the encouragement of the White House and with NASA participation in looking at what steps the Government can take and we'll be glad to tell you about this from our standpoint, but of course, we don't know what the President—who has not seen it yet, will do.

There's also, as Jim said, an advisory mechanism that has been advising Jim in how this matter should be handled internally and I've been a part of that one so there's a little bit of confusion here.

Thank you.

[The prepared statement of Mr. Townsend follows:]

Statement of Dr. John Townsend, Jr.

Before the Sub-Committee on Space Science
and Applications

Mr. Chairman, I am John W. Townsend, Jr., President of the Fairchild Space Company in Germantown, Maryland. I am pleased to have this opportunity to discuss my views on the actions which should be taken to provide a suitable climate for the development by the United States of the new economic frontier in space. As you know, twenty-five years of space technology development has given birth to one very successful area of economic activity -- communication satellites. This, in turn, has been one of the keys to U.S. leadership in the information and computer revolution. Now, with the success of the space shuttle, we have the opportunity to develop new manufacturing and research industries which benefit from the properties of space. However, just as development of the communication satellite industry required affirmative support in its formative stage, a number of actions are required now if the new economic potential of space is to be realized.

Over the last several months, representatives from a number of private sector organizations have been working with the encouragement of the White House and NASA to identify a series of steps which the Government could take to aid the development of new U.S. Commercial space ventures. The recommendations of this group have been sent to the White House and are being reviewed by an inter-agency working group to assess the feasibility of the various recommendations. A package of final recommendations and agency comments will shortly go to the White House. These recommendations cover both the elimination of barriers to commercial activity in space and the generation of positive incentives for such activity. It is hoped that, in the next several weeks, the President will select the actions which he desires to take. Some of these actions are likely to involve steps which can be accomplished within the Executive Branch. Others are likely to require Legislative action. My purpose today is to discuss certain of the more important issues and suggest possible solutions.

I believe that actions in three areas are the keys to achieving our commercial objectives in space. First, NASA's program of support for commercial ventures in their initial phases should be strengthened and streamlined. Second, we should actively work toward making the shuttle a flexible transportation system optimized toward taking full advantage of its unique capabilities at the lowest user cost. Third, the government should correct a number of tax, legal, and regulatory barriers to commercial activities in space.

The major strength of the effort to initiate commercial activities to date has been NASA's Joint Endeavor Agreement (JEA)/Technical Exchange Agreement (TEA) program. This program has encouraged a number of organizations to initiate programs of research and

product development. Fairchild, for example, could not have initiated its Leasecraft program without a JEA. However, the procedures for obtaining a JEA or TEA and the possible provisions of such an agreement are not well defined. This is a major problem for organizations which are not familiar with NASA and which have very limited resources to spend on long complex negotiations. This situation, of course, works against the inclusion of non-aerospace firms and small start-up companies, although there has been some success in getting both involved. In addition, many potential product development activities require costly facilities even for the earliest stages of basic R&D. In some cases, the initial size of the investment in such facilities is prohibitive when the prospect for ultimate success is so uncertain and so far in the future. There are many examples in the past of our government's support of early investments leading to growing private investment and ultimate substantial long term economic success. Development of the U.S. commercial airline business is only one. Therefore, I believe that NASA should take two steps in the near future. First, streamline the JEA/TEA process and second, initiate a program to make R&D facilities available to the private sector for use in the early phases of materials processing and research-in-space projects. I believe that these steps will encourage many more companies to make the initial commitments which will lay a foundation for future major projects.

The second area of action involves the shuttle which is a tremendous technical success but is only starting to live up to its promise as a system for two-way transportation and service in space. To fulfill that promise the shuttle must provide service which responds in a timely fashion to emerging user needs and which charges a predictable and affordable price. As long as customers are dealing with potential products with uncertain markets and technical risk, it is clear that inflexible transportation which must be scheduled years in advance at high and uncertain cost is a severe limitation. It is certain that improving this situation is a major management challenge for NASA but it is also clear that progress would produce significant growth in all of the potential users of the shuttle. I fully realize that my request for low shuttle prices is counter to those who feel that we need to raise shuttle prices to encourage development of a commercial ELV industry. However, since I believe that high shuttle prices in the early years of materials processing industry in space will preclude its success, I think we must find a pricing structure which allows both new industries a chance to succeed. Serious attention must be given to this problem, as well as the need to hold down government expenditures, before a decision on shuttle pricing is made.

Finally, we need to address a number of specific barriers to commercial activities in space. The most important of these relates to the problem that space is neither a foreign country nor a part of the United States. This has led to a situation where the export control and International Traffic in Arms Regulation (ITAR) regulations are being used to regulate private launches into space, where tax incentives available to ventures on earth are not available to space

ventures, and where there is concern that products manufactured in space could be taxed as imports when landed in the United States. The material prepared for the White House addresses all of these issues. We have suggested that the administration issue a policy statement that the ITAR and export control mechanisms are only a temporary method of implementing U.S. treaty obligations to control launches into space by U.S. activities and that an immediate effort will be initiated to develop a more appropriate mechanism. It is likely that this will require legislation.

The major current tax problem resulting from space not being part of the United States involves the investment tax credit. Under current law, capital projects in the United States qualify for a 10% investment tax credit. This provision was enacted to provide an incentive for capital investment. It seems obvious that we need to encourage capital investment in facilities in space if we want to develop a commercial space industry. Unfortunately, this incentive is denied to projects in space since only assets placed in service in the United States can qualify. In 1971 Congress exempted communication satellites from that requirement thus clearly recognizing the need to correct the problem for the only type of commercial satellite then envisioned. I believe that the President will recommend legislative action to correct this deficiency in the Tax Code thereby extending the communication satellite treatment to other non-expendable capital assets in orbit.

The uncertain tax status of space provides a number of other problems. So far no one has manufactured significant quantities of valuable products in space and returned them to the United States. Therefore, there has been no real issue on whether such an activity is an import. However, it does not require much imagination to see how such a situation could be considered an import subject to tariffs. Also, the tax code is unclear on whether income earned by a spacecraft is U.S. or foreign source income. In some cases, this can cause a major difference in the taxation of a U.S. taxpayer. We believe that action should be taken to establish the principles that products manufactured in space by U.S. ventures are <u>not imports</u> when landed in the U.S. and spacecraft income is U.S. source income to U.S. taxpayers. We believe that the administration will support action to accomplish those objectives.

Our recommendations to the White House address a number of other tax and regulatory problems. These range from difficulties in gaining commercial access to radio frequencies through the possibility that certain benefits provided by NASA as part of its commercial incentive program could be considered taxable income by the IRS. We believe that actions are needed to correct all of these problems.

As I indicated earlier, I believe that the White House will adopt a series of action recommendations on these and other space commercialization issues over the next few weeks. A few of these actions will require legislation; most will need administrative actions. I suggest that this Committee should continue to show its present high level of interest on the effect to encourage space commercialization. Once the White House recommendations are ready, the Congress should review the proposed legislative actions and proceed to enact the necessary legislation as quickly as possible.

Thank you, Mr. Chairman.

Mr. VOLKMER. Thank you very much.

Mr. Kline, you may proceed.

Mr. KLINE. Thank you, Mr. Chairman. I appreciate the opportunity to address you on the subject of space commercialization.

Now that the shuttle is becoming operational, it is possible to enter an important new phase of our civilian space program which builds upon our investment of 20 years of technology to turn it to advantage in the commercial sector.

I think that the probability, however, that this space commercialization frontier will be utilized to the benefit of U.S. industry depends critically upon the actions which our Government takes in the next few years. With the proper set of actions, new and broadly diverse high-technology commercial enterprises will develop to significantly stimulate our American economy.

Market expansion approaches, economic incentives, and legal and regulatory issues all need to be put together in considering and developing an effective space commercialization policy.

As you had referred to me in your letter originally on the subject inviting us to talk about the industrial space commercialization group study, I will report to you on the results of this focusing in on the market expansion activity which the area—which was the area for which I was responsible.

Coming out of this, I will concentrate on a set of actions which I believe our Government should take, and in my opinion, NASA is the appropriate agency to be asked to implement them. The series of actions involves, however, a new segment of U.S. industry with which NASA will be dealing.

As an admirer of NASA, I'm confident of their ability to do the job, but it will require a different approach by the agency. I am not recommending business as usual.

Grumman is seriously considering expanding our space activities into the commercial area. The results of our work are promising and while certainly not complete, we do believe there is a future space commercialization opportunity for an area which we are looking at and we're definitely interested in its potential.

Over the past 2 years, we have also undertaken an awareness program with the nonaerospace community. The goal which we had was to help stimulate and develop commercial users of the space Shuttle with possible long-term projections directed toward eventual use of the space station. What we did was to establish a personal direct contact with these companies and provide them with an understanding of the potential benefits of space.

Of the 18 major companies that we have visited and interacted with in depth, 13 have indicated an interest in considering experiments in space processing, and 2 of these companies are developing proposals for near-term experiments.

We consider this very encouraging, but we recognize and must hasten to say that there is still a long way to go before there will be active participation.

Re the subject of "space commercialization," this term is used in a very general sense sometimes to include expendable launch vehicles, upper-stage-transportation services and platforms, services which can be provided by the Government or can be through privatization be provided by industry. My comments now are directed

in a more specific sense to the entrepreneurial development of new products that will be manufactured in space, taking advantage of the very low-gravity environment and the limitless vacuum which can be found in Earth orbit.

This, I believe, holds great promise for the U.S. industry, and for industrialists, and entrepreneurs throughout the world. The question will be: Who gets there first and really capitalizes upon these opportunities, United States or other interests?

Sam, if I could have the first View-graph, please.

[View-graph.]

Mr. KLINE. I recommend that we target four thrusts which will help stimulate commercial interest in space material processing. These four thrusts are: Government/NASA leadership—primarily to provide responsiveness to private industry needs; second, lowering the initial upfront risks; third, expanding the research data base to give the scientific evidence of the process feasibility; and then fourth, is broadening the private sector awareness of the commercial space opportunities.

Let me define the specific actions in each of those four areas which I feel should be taken at this point. Re the Government/NASA leadership, NASA must be able to respond rapidly to the needs of the commercial developer or else it will be viewed as a poor and impractical partner. To accomplish this, we are creating a central, high-level NASA office which can identify the available resources within the agency and which has the power to make needed policy decisions promptly.

Confidence must be developed that future user needs will be met. We must make it clear that our shuttle schedule will be modeled after scheduled airline operations.

Next View-graph, please, Sam.

[View-Graph.]

Mr. KLINE. And the second point, then, is that of lowering initial front-end costs—risks, pardon me. We need to stimulate the private sector to invest a portion of its own R&D effort in the early development of space commercial enterprises. This can be accomplished by supporting the private sector's front-end development of the new space technology, aiding initial development of a technical and process development plan for the space-based venture, and providing exclusivity for those willing to take the risks.

I recommend that we help entrepreneurial businesses accept their concept development with NASA in seed money contract agreement support.

Now, what I am proposing here is something which should not be confused with the current NASA research contract programs that are undergoing right now. They're valuable in their own right, but I am talking about a different kind of incentive now to the entrepreneurial segment of our industry.

I recommend further that in this activity that industry, not NASA, identify the R&D areas of interest and conduct the research, and so it is ~~in~~ that direction that I would recommend the creation of a high-level focal point to organize this activity.

Sam, you've got to go one more View-Graph, please.

[View-Graph.]

Mr. KLINE. OK.

Now, if I go to the next View-Graph——

[View-Graph.]

Mr. KLINE [continuing]. My fourth point, then, is expanding the research data base for commercial space ventures. Commercialization of America's space program will result in an increasing need for research data which can be used by industry to develop space-related products and services.

NASA is doing basic research work at the moment on how materials act in near weightlessness. This modest materials processing analytical and experimental program is useful and should be strengthened. Additional generic research in microgravity and high vacuum, useful to many members of American industry, is needed to maintain technical superiority in the materials, chemical, and biological sciences.

At the same time that I recommend expanding the funding for NASA's microgravity research activity, I recommend the appointment of a high-level industry/university space commercialization advisory board to advise NASA on the most critical industrial basic research needs.

Appointment on such a committee, I would recommend be for 2 or at most 3 years, to make sure that it in itself does not become institutionalized. I would recommend that the increase in budget, as I have suggested, be at the rate of $10 million per year.

Lastly—next View-Graph, please, Sam——

[View-Graph.]

Mr. KLINE [continuing]. Is that of broadening the private sector awareness of commercial space opportunities. Entrepreneurial activity will be stimulated if awareness of commercial space opportunities can be broadened beyond the aerospace community. The commercial technical community must be made aware of space research results.

I recommend an increase in efforts to heighten private sector awareness of space commercialization opportunities through increases in publication of experimental data, not in the journals, which all of us in aerospace read, but in the nonaerospace industry journals and technical reports. Expand the research incentives for space commercialization and then make use—and we noted this in our committee reviews—that the Department of Commerce currently has 8 regional and 48 district offices which are available throughout our country. I think they can be used to the advantage of NASA in this program.

And then lastly, making use of the low-g centers of excellence, which you referred to before, which I believe can be used to help facilitate the transfer of information. The estimate that we would make for accomplishing this activity is $5 million in fiscal year 1985.

In conclusion, then—next View-Graph, Sam——

[View-Graph.]

Mr. KLINE [continuing]. Although we see space commercialization in its formative stage where it's too early for anyone to tell for sure which products will be most successful, the business opportunities are real and potentially enormous. I have recommended now, with a budget of $40 million per year, a program which gives us the opportunity to lay the foundation for an emerging new indus-

try and accelerate our technologies in the presence of foreign competition. And we are there. It is important to recognize that we as a nation have competition as we pursue our space commercialization projects.

Our friends in Europe and Japan already have vigorous space processing activities under way and we face another type of competition from the Soviets with their reported work on space manufacturing on board their Salyut manned space station.

We at Grumman firmly believe that a commitment by this Government to encourage space commercialization business is needed, and we will support this action as part of our civilian space program. As this policy is undertaken, we see the need for the establishment of a permanent manned space station facility.

Its impact would send a powerful message to this country's industrial community that commercial activity in space can be planned for and undertaken on a major scale. We must remain preeminent in space, both commercially and operationally, as well as scientifically. The time is now. I say we should go for it.

Thank you.

[The prepared statement of Mr. Kline follows:]

STATEMENT BY

RICHARD L. KLINE

DIRECTOR, SPACE STATION PROGRAMS

GRUMMAN AEROSPACE CORPORATION

Dick Kline has been associated with Grumman since his college days at Yale University which he attended on a Grumman Engineering Scholarship. He graduated from Yale with a Bachelor of Science in Mechanical Engineering degree in 1955. He held a Stewart Fellowship at Princeton University from which he received his Master of Science degree in Mechanical Engineering. Mr. Kline has also done graduate work in mathematics and physics at the Polytechnic Institute of Brooklyn, New York, and in 1973 he completed the Program for Management Development at Harvard University's Graduate School of Business Administration.

In addition to being a licensed New York State Professional Engineer, Mr. Kline is an Associate Fellow of the American Institute of Aeronautics and Astronautics, Deputy Director for Aerospace Systems, in the AIAA Technical Group for Aerospace and Information Systems and is a Director of the American Astronautical Society. He is a member of the National Mechanical Engineering Honor Society, Pi Tau Sigma, the National Scientific Society, Sigma Xi, the American Society of Mechanical Engineers and the Society of Automotive Engineers.

SPACE COMMERCIALIZATION
AS VIEWED BY GRUMMAN AEROSPACE CORPORATION
by RICHARD KLINE
For Presentation to the U.S. House of Representatives
Committee on Science and Technology
Subcommittee on Space Science and Applications

June 19, 1984

Mr. Chairman and members of the Subcommittee on Space Science and Applications, I am Dick Kline, Director of Space Station Programs for the Grumman Aerospace Corporation.

I appreciate the opportunity to address you on the subject of Space Commercialization. Now that the Shuttle is operational it is possible to enter an important new phase of our civilian space program which builds upon our technical capability and turns it to our advantage in the commercial sector. The probability, however, that this new Space Commercialization frontier will be utilized to the benefit of U.S. industry depends critically upon the actions which our Government takes in the next few years. I believe that with the proper set of actions, new and broadly diverse high technology commercial enterprises will develop to significantly stimulate the American economy.

Market expansion approaches, economic incentives, and legal and regulatory issues all need to be considered in developing an effective Space Commercialization policy. Because you will be hearing testimony from others on the economic incentives, and legal and regulatory issues, I will concentrate on the market expansion approaches, or how we can lower some of the current barriers to industry participation in space commercialization ventures.

I am going to recommend a series of actions which I believe our Government should take and, in my opinion, NASA is the appropriate agency to be asked to implement them. The series of actions involves a new segment of U.S. industry with which NASA will be dealing. As an admirer of NASA, I'm confident of their ability to do the job but it will require a different approach by the agency. I am not recommending "business as usual".

Background

Grumman Aerospace Corporation has participated in our nation's space program for over two decades. Under NASA contract we designed and built the highly successful Orbiting Astronomical Observatory and the Lunar Module for Project Apollo. We are currently supplying the Wings for the Shuttle and have a major role in Shuttle Processing at the launch site. We are now seriously considering expanding our space activities into the commercial arena. Over the past ten years we have been involved with both corporate and NASA funding in developing space manufacturing technology. Our initial interest is in one type of materials manufacturing in space called directional solidification using a space furnace of special design. Grumman Aerospace research scientists have undertaken a series of ground analyses and test programs which have given us significant insight into the theoretical performance of certain materials when melted and then allowed to solidify under controlled conditions in space. Specifically, we have flown material processing experiments on Skylab, Apollo/Soyuz and six rocket flight missions. In addition, we are scheduled to continue this work in the future on three shuttle flights, the first of which is manifested on STS-41F to be flown in August, 1984.

The results of our past work in this area are promising and, while certainly not complete, we do believe there is a future commercial business opportunity for this segment of space processing and Grumman is definitely interested in the potential which lies ahead in this area.

Over the past two years, we have also undertaken an awareness program with selected non-aerospace companies. The goal was to help stimulate and develop commercial users of the Space Shuttle with possible long-term projections directed toward eventual use of the Space Station. Our approach was to establish personal contact with these companies and provide them with an understanding of the potential commercial benefits of space. We are continuing this interface work with non-aerospace industries under a NASA contract in association with Coopers and Lybrand, a worldwide auditing firm.

Of the eighteen major companies visited so far, thirteen have indicated interest in considering experiments in space processing and two of these companies are developing proposals for near term experiments. These are encouraging results although there is still a long way to go before there will be active participation.

An additional benefit from these interactions with non-aerospace companies was that we gained some unique insight into the needs and concerns which these companies perceive when evaluating the risks and rewards of embarking on a space commercialization program.

Last summer Grumman, with other companies, performed a Commercialization Space Group study and presented its results to the Administration and congressional staff. The purpose of the study was to appraise opportunities for, and impediments to the commercial use of space. Grumman coordinated a subgroup of this study which considered ways for expanding the commercial space market. Many of the comments in this paper relate to this work.

Discussion and Recommendations

The term "Space Commercialization" is sometimes used in a very general sense to embrace Expendable Launch Vehicles and Upper Stage transportation services provided by private industry. My comments, however, are directed in a more specific sense to the entrepreneurial development of new products which will be manufactured in space, and new services which can be provided in space. These include the development of new products which capitalize on the uniqueness of the very low gravity environment or vacuum which can be found in Earth Orbit. The use of low gravity experimentation may contribute to new and better products manufactured in space or provide an understanding of processes which eventually will be used to produce materials and goods on the ground. This, I believe, holds great promise for the United States industry and for industrialists and entrepreneurs throughout the world. The question will be; who gets there first and really capitalizes upon these opportunities, U.S. or other interests?

I recommend we target four thrusts which will help stimulate commercial interest in space material processing. These four thrusts are:

I. Government/NASA Leadership - to provide responsiveness to private industry needs.

II. Lowering the Initial Front-end Risks - to reduce the high risk/high cost impediments

III. Expanding the Research Data Base - to provide scientific evidence of process feasibility.

IV. Broadening the Private Sector Awareness of Commercial Space Opportunities - at both industrial and academic levels.

Let me define the specific actions which I believe should be taken in each of these target areas.

I. Government/NASA Leadership

NASA must be able to respond rapidly to the needs of the commercial developer or else it will be viewed as a poor and impractical partner. To accomplish this I recommend:

- Creating a central high level NASA office which can identify the available resources within the agency and which has the power to make needed policy decisions promptly.
- Providing ready access to shuttle flights. If a product developer must wait for long periods between shuttle flights to get his experimental data, he runs the risk of being beaten to the market by a competitor who may have an alternate process which can be introduced quickly and ahead of the more ideal space process. We must work to improve flexibility in manifesting Shuttle payloads and cutting the time of ground preparation.
- Developing confidence that future user needs will be met. We must make it clear that our shuttle schedule will be modeled after scheduled airline operations.

II. Lowering the Initial Front-end Risks

We need to stimulate the private sector to invest a portion of its R&D effort in the early development of space commercial enterprises. This can be accomplished by supporting the private sector's front-end development of the new space technology, aiding initial development of a technical and process development plan for the space-based venture, and providing exclusivity in joint endeavors for those willing to take the risks of being first-to-market.

At present, the venture capital market is too small to support significant space-related investment. Financing arrangements are normally under $5 million with an upper limit rarely above the $75-million range. Developing space-qualified facilities can cost ten to one hundred times as much as Earth-based facilities. Such large capital outlays will inhibit development or result in only a few projects which have low downside risk. To reduce initial investment risk, it is recommended that NASA help off-set these high, space-related front-end costs.

I recommend that we (1) help entrepreneurial businesses initiate their concept development with NASA "seed money" contract agreement support. (This should not be confused with current NASA research contracts which are valuable in their own right to develop a basic science research data base). These agreements should be directed toward application-oriented projects with a reasonable promise of resulting in viable commercial products. In this activity, industry (not NASA) identifies the R&D areas of interest and conducts the research; (2) continue to offer reduced-rate Shuttle flights for development of promising new commercial concepts during the start-up and proof-of-concept phase of commercial space product development; (3) reduce Shuttle integration costs borne by the entrepreneur; (4) provide terrestrial and spaceborne materials-testing facilities, for commercial use and (5) extend the period of exclusivity to the commercial production point as a means of protecting those willing to assume the R&D risks. The cost of this activity is estimated at $25M per year.

III. Expanding the Research Data Base for Commercial Space Ventures

Commercialization of America's space program will result in an increasing need for research data which can be used by industry to develop space-related products and services. Two kinds of experimental data are required: basic research data and applications data which will support specific high-value commercial ventures.

NASA is currently doing basic research work on how materials act in near-weightlessness. This modest materials processing analytical and experimental program is useful and should be strengthened. Additional generic research in microgravity and high vacuum useful to many members of American industry is needed to maintain technical superiority in the materials, chemical and biological sciences.

I recommend that we (1) expand funding for NASA's microgravity research budget including establishment of industry/university/government "Low-g Centers of Excellence" and (2) appoint a high-level industry/university Space Commercialization Advisory Board to advise NASA on the most critical industrial basic research needs. A $10M increase in the FY'85 budget is recommended.

IV. Broadening the Private Sector Awareness of Commercial Space Opportunities

Entrepreneurial activity will be stimulated if awareness of commercial space opportunities can be broadened beyond the aerospace community. The commercial technical community must be made aware of space research results. Procedures for gaining access to government experts and facilities must become common knowledge to that community.

I recommend an increase in efforts to heighten private sector awareness of space commercialization opportunities through: (1) increased publication of experimental data in non-aerospace industry journals and technical reports; (2) expansion of research incentives for space commercialization (e.g., academic grants, small business innovative research programs, and announcements of opportunity for commercial space endeavors); (3) use of Department of Commerce regional and district offices and advisory committee structures; and (4) utilization of the industry/university/government "Low-g Centers of Excellence" previously recommended to facilitate transfer of information from NASA sponsored academic research to industry.

These actions would help reach industries whose products are likely to benefit from space-based commercial endeavors. They also would provide the opportunity to establish institutional mechanisms for better linkage between NASA's and academia's basic research and industry's applications research. These recommendations would require approximately $5M in FY 1985 funding. This could speed "to-market" efforts to better meet foreign competition. It would also, permit a modest program of seminars and study support to expose future technical leaders to commercial opportunities opened by our improved access to space.

Conclusion

Although Space Commercialization is in its formative stage where it's too early for anyone to tell for sure which products will be most successful, the business opportunities are real and potentially enormous.

It is important to recognize that we as a nation have competition as we pursue our space commercialization projects. Our friends in Europe and Japan already have vigorous space processing activities underway, and we face another type of competition from the Russians, with their reported work on space manufacturing on-board their Salyut Manned Space Station.

In view of the projected space commercialization opportunities for this country and the growing international competition, I believe we should move forward aggressively with a coordinated Government/Industry program embracing the four target areas for action which I have suggested here today. With a budget of $40M per year, we have the opportunity to lay the foundation for an emerging new industry and accelerate our technologies in the presence of foreign competition.

We at Grumman firmly believe that a commitment by this government to encourage space commercialization business is needed and we will support this action as part of our civilian space program. As this policy is undertaken, we see the need for the establishment of a permanent manned Space Station facility. It would send a powerful message to this country's industrial community that commercial activity in space can be planned for and undertaken on a major scale.

We must remain pre-eminent in space -- both commercially, and operationally as well as scientifically. The time is now -- I say we should go for it!

Mr. VOLKMER. Thank you very much, Mr. Kline.

We will now proceed with Mr. Hood.

Mr. HOOD. Thank you, Mr. Chairman. I, too, in the interest of time, will summarize my statement. Certainly you, as well as anyone, are familiar with the commercialization projects that McDonnell Douglas has carried out for years.

I would like to make one or two points, though. It's certainly true that without NASA's joint endeavor agreement, the realism of the new products that we hope will be provided through the EOS process certainly would be very, very slim.

Also, I would like to point out to you that if you read my statement, you will begin to see that the commercialization of space entails great teamwork and cooperation on both the part of industry and government. Certainly, if we are to nurture commercialization of space, we must, therefore, look at ways to make rates of return for space projects competitive in the eyes of the free enterprise risk taker.

In that regard, I have submitted three recommendations for the committee's consideration. I can assure you, Mr. Chairman, that not all these recommendations will be popular, especially the one on industry/Government risk sharing. However, I believe the question is a simple and clear one: Will we develop space for commercialization purposes, and if so, will we do it aggressively or will we do it reluctantly with just enough emphasis to keep up with our international friends?

I, like you, Mr. Chairman, believe the President expects us to make aggressive moves to commercialize space and it is in that spirit that I strongly urge the Congress to support these recommendations which will bring the Government and private industry together as partners, enabling us to turn the opportunities of space into business opportunities and benefits to our Nation.

Incidentally, Mr. Chairman, lest we have forgotten, it was not long ago that the Government was assisting in establishing incentives for the airline industry, the communications industry, the alternate energy market and, yes, even the railroads. Without those incentives to encourage development, it is conceivable that our Nation would not be as economically strong as it is today. I look at our challenge now to be successful in the commercialization of space and to do that, we must get broad participation by industry, and as I think Mr. Beggs pointed out earlier, not only from small companies, but from large companies, and not only from the aerospace business, but from the steel business, from the metals, from the ceramics and plastics and all the way to the drugs and genetics and medicine.

The subcommittee, by supporting our recommendations and by encouraging a strong bond between Government and private industry will help us meet that challenge.

I would like to say one other thing, Mr. Chairman, and that is that I would like to congratulate the members of your subcommittee and you, particularly with your outstanding job that you did in guiding the manned space station authorization through Congress. I know that was no easy task, and while we're not here to talk about the manned space station today, certainly that's going to play a significant part, clearly not only in commercialization, but I

think we have sent a message around the world and put the world on notice that the United States is going to maintain its leadership in space. It's that same leadership I hope you will provide to the space commercialization issues.

[The prepared statement of Mr. Hood follows:]

STATEMENT OF ROBERT H. HOOD, VICE PRESIDENT, STRATEGIC PROGRAM DEVELOPMENT, MCDONNELL DOUGLAS ASTRONAUTICS CO.

Mr. Chairman and members of the Subcommittee on Space Science and Applications, I am Bob Hood, Vice President of Strategic Program Development for McDonnell Douglas Astronautics Company.

I am pleased to have this opportunity to appear before this distinguished Subcommittee. I am here as a representative of the Industry-Space Commercialization Task Force to respond to your request for private industry's recommendations and experience regarding Space Commercialization.

In the last decade, McDonnell Douglas has undertaken four commercial space ventures. Three of these ventures were aimed at extending our launch vehicle product line, in response to world launch service requirements. The fourth venture is space processing, which we anticipate will add a new dimension to McDonnell Douglas' business base.

The first of these commercial space projects was upgrading the Delta launch vehicle for the communication satellite industry. This venture involved a three-part agreement between NASA, RCA, and McDonnell Douglas. McDonnell Douglas agreed to perform all nonrecurring design, development, and tooling without cost to the Government. NASA agreed to use the design, maintain the modified tooling and facilities, and implement the production and launch obligations as additions to the contracts held by MDC. RCA agreed to buy three vehicles and to pay up-front user costs as a form of venture capital.

This venture proved extremely successful and all parties benefited.

The second commercial space project was a shuttle-compatible upper stage we refer to as the PAM (for Payload Assist Module). This project was initiated by an agreement signed by NASA and MDC in November of 1976. In general, this agreement committed us to develop an upper stage on a schedule compatible with the shuttle operational requirements and market it to commercial users at a not-to-exceed negotiated selling price -- all at no cost to the Government.

In exchange, NASA agreed that they would not fund, nor formally solicit the development of, a competitive system. A similar agreement was negotiated with NASA when we developed a new, higher-performance version of the vehicle.

For the last eight years, with our own funds, McDonnell Douglas Corporation has been working on the much-publicized Electrophoresis Operations in Space project. This project involves a device that will be used in space to obtain certain proteins and cells by separating them from other biological materials. While it will still be several more years before commercial products developed through this process will be available on the marketplace, we could not have progressed even as far as we have without the Joint Endeavor Agreement, which establishes an industry-government relationship. Under this arrangement, NASA is providing free flight support to MDAC for precommercial research and development, and MDC is investing front-end money to develop the process technology, flight hardware, and new products. Without this agreement, the realism of new products to provide new or better medical treatments would have been slim.

By now, Mr. Chairman, I'm sure you are beginning to see that commercialization of space entails great teamwork and cooperation between industry and Government.

Commercial space projects such as EOS are typically long-range and high-risk. In our free-enterprise system, they involve discretionary expenditures that must compete for capital with alternative investment opportunities.

In the case of space projects, the elapsed time to attain commercial feasibility will probably be greater than with conventional projects. The combination of high risk and longer times to payoff with market uncertainties and changing national policy places space programs at an economic disadvantage to alternative investments.

If we are to nurture commercialization of space, we must, therefore, look at ways to make rates of return for space projects competitive in the eyes of the free-enterprise risk taker.

As a member of the Industry-Space Commercialization Task Force, I would like to submit for the record our recommendations of the following economic incentives that we feel can be applied to help stimulate the competitiveness of space endeavors: (1) establishing tax credit allowances for research and development, (2) developing approaches for Government/industry risk sharing, and (3) facilitating insurance coverage for spacecraft owners.

I can assure you, Mr. Chairman, th't not all these recommendations will be popular, especially the one on Government/industry risk sharing. However, I believe the questions before all of us are clear.

1. Will we develop space for commercial purposes?

2. Will we do it aggressively, or will we do it reluctantly, with just enough emphasis to keep up with our international friends?

I believe the President expects us to make aggressive moves to commercialize space. It is in that spirit that I strongly urge the Congress to support these recommendations, which will bring the Government and private industry together as partners, enabling us to turn the opportunities of space into new business opportunities and benefits to our nation.

Incidentally, Mr. Chairman, lest we have forgotten, it was not long ago that the Government was assisting in establishing incentives for the airline industry, communications satellite industry, alternate energy market, and yes, even the railroads. Without those incentives to encourage development, it is conceivable that our nation would not be as economically strong as it is today.

Our challenge now is to be successful in the commercialization of space. To do that, we must get broad participation by industry -- from small companies to large, from businesses in aerospace, steel, metals, ceramics, and plastics to those in drugs, genetics, and medicine.

The Subcommittee, by supporting our recommendations and by encouraging a strong bond between Government and private industry, will help us meet this challenge.

Thank you Mr. Chairman.

ATTACHMENT 1

SPACE COMMERCIALIZATION

ECONOMIC INCENTIVES RECOMMENDATIONS

Issue II-1: What Changes are Needed so R&D Tax Credit Laws Do Not Exclude Commercial Space Ventures?

A. Background

The R&D tax credit allows a 25-percent reduction of the qualified cost of research and development directly from tax liability. However, there are a number of restrictions on the use of the R&D credit by space-based businesses.

1. The firm must be carrying "on a trade or business", which means that a new firm or an existing firm entering a new line of business cannot use the R&D credit. Since space commercialization would be a new line of business for almost any firm, it will be extremely difficult for space ventures to pass the "carry-on" test. However, the current Senate tax bill will correct for this in the case of corporate taxpayers.

2. The R&D tax credit is 25 percent of the research expenditures above the average amount of the taxpayer's yearly qualified research expenditures in the base period, which is generally the last three taxable years. Many space ventures will involve new firms with no previous research to credit towards the base period. Existing firms will have an unfair tax advantage over new firms even though many innovative products come from new firms.

3. The firm must conduct the research in-house. Only 65 percent of the costs of contract research expenses are treated as qualifying expenses for purposes of the R&D credit. Firms entering the space business usually have experience with a product or with the development of space hardware, but usually not both. Therefore, it will be necessary for them to obtain part of the R&D work through partnerships or subcontracts. The provision against third-party R&D unfairly handicaps firms lacking R&D capabilities in all facets of a space venture.

4. The firm cannot transfer the R&D products for license or royalty payments. This provision discriminates against firms possessing R&D expertise but lacking the ability to bring a new space product to market.

B. Proposals

The following actions would encourage space commercialization ventures:

Option 1

Eliminate the "carry-on test" in the ERTA Section 221.

Option 2

Eliminate the three-year base period for research expenditures to qualify for the R&D tax credit.

Option 3

Remove the limitation on research performed by third parties in Code Section 44F.

Option 4:

Modify Code Section 44F to allow transfer of R&D products for license or royalty payments.

Option 5:

Implement all changes in Options 1 through 4.

C. Analysis

Implementation of all the options would remove discrimination against space ventures in the tax code, would provide more flexibility to entrepreneurs in setting up space ventures, and would increase the profitability of space ventures by reducing the tax liability, thereby stimulating investment in space. The increased use of the R&D credit would reduce Government tax revenues but the loss would be offset by the long-term tax and social benefits of commercializing space.

D. Decision

Option 1 _____ Eliminate the "carry-on test."

Option 2 _____ Eliminate the three-year base period for research expenditures to qualify for the R&D tax credit.

Option 3 _____ Remove the limitation on research performed by a third party in Code Section 44F.

Option 4 _____ Modify Code section 44F to allow transfer of R&D products for license or royalty payments.

Option 5 _____ Implement all of the changes recommended in Options 1 through 4.

December 8, 1983

Issue II-3: What Government Mechanisms Can Help Attract Capital for Space Ventures?

A. Background

Initial financing requirements for space ventures can range up to several hundred million dollars. The risk associated with operating in space is generally high compared to conventional Earth-based businesses. Many of the companies involved in commercializing space are new companies that do not have financial track records or are existing companies entering a new line of business. The markets for many space products are often uncertain and susceptible to competition from Earth-based products.

For these reasons it will be very difficult, at least in the early stages, for a company to obtain adequate financial backing for a space venture. Traditional loans at normal interest rates (10-25 per cent) will not be available. Internal financing is available only to well-established companies with positive cash flows. Venture capital is accessible to most companies but the payback period is typically three to five years - - too short for space ventures that may not pay off for eight to 10 years. Venture capitalists also charge a very high premium either in the form of equity or interest.

B. Proposals

To make investment capital available to space ventures at reasonable rates, the following mechanisms are available. The changes recommended in issue papers II-1 and II-2 will also help in this regard.

Option 1:

Government-guaranteed loans or bonds. -

Option 2:

Government purchase of options on the securities issued by commercial space endeavors.

Option 3:

Allow new and established companies to raise venture capital through the sale of R&D debentures or bonds. The purchase price of these debentures would be deductible immediately by the individual investors rather than the R&D firm.

Option 4:

Provide partial market assurances to new space businesses if the Government has a need for the product and if the Government purchase leaves significant private capital at risk.

C. Analysis

The first option -- Government guarantees -- could make low-cost capital available. However, the Government would be assuming most of the risk that is traditionally the responsibility of the private sector. Option 2 was used successfully with the Chrysler Corporation and turned out to be profitable also for the Government. However, Option 2 also requires the Government to take most of the risks and may distort private capital markets.

Option 3 would allow private investors to deduct investment costs from their tax liability. This would increase the return on their investment and thereby encourage more investments. There would be little or no loss in tax revenues to the Government since the tax liability is only transferred, not eliminated.

Option 4 would permit Government purchase of a new space venture's product. These Government purchases would be limited to those products for which the Government has a need. The purchases would be limited to a small percentage of the market required to make the venture a commercial success so that significant private sector capital is at risk. This would assure that a strong private market exists for the product. It also would reduce the Government risks in comparison with the loan guarantee option. The Government purchase would help the new space venture raise capital as it would demonstrate some initial cash flow.

D. Decision

Option 1 _____ Government-guaranteed loans or bonds.

Option 2 _____ A mechanism for Government purchases of options on securities issued by commercial space endeavors.

Option 3 _____ Allow new and established companies to raise venture capital through sale of R&D debentures or bonds.

Option 4 _____ Provide partial market assurances to new space businesses if the Government has a need for the product and if the Government purchase leaves significant private capital at risk.

Option 5 _____ None of the above.

November 30, 1983

Issue II-7: How Can Adequate, Cost-Effective Insurance for Commercial Space Ventures Be Assured?

A. Background

A major area of concern in commercialization is the possibility that insurance requirements may exceed the capacity of the insurance industry to cover liabilities. One problem is the possibility of an unforeseen accumulation of exposures in the event of manifest changes on the Shuttle. Most insurers will only commit a portion of their capacity to any one payload, thereby reducing the risk on a given mission. A capacity problem could also develop on a dedicated Shuttle mission on which the single payload requires insurance in excess of market capacity.

Spacecraft owners are also concerned over the postponement and occupancy fees for Shuttle payloads. These fees can be substantial, even if the delay is not caused by the spacecraft owner. Insurance to protect against these fees at reasonable rates has not been available.

B. Proposals

Option 1: Direct NASA to:

(1) Provide technical information to insurers to enable them to better evaluate the risks of space operations.

(2) Brief insurers to update them on space developments.

(3) Include insurance availability as a factor in developing the Shuttle manifest.

(4) Reduce postponement fees for causes beyond the control of the spacecraft owner or when insurance is not available at a reasonable cost.

Option 2: Maintain the status quo.

C. Analysis

Option 1 may help reduce the problem of insurance availability without a significant impact on the NASA budget.

D. Decision

Option 1: _____ Direct NASA to undertake the recommended activities.

Option 2: _____ Maintain the status quo.

Mr. VOLKMER. Thank you very much, Mr. Hood.

First, the gentleman from California—have any questions of the panel?

Mr. BROWN. Let me offer a comment or two, Mr. Chairman.

First, I very much appreciate all of the testimony. I think it's challenging and do I correctly infer that all of you gentlemen were part of this task force that was involved in preparing recommendations for the White House or——

Mr. TOWNSEND. No; the two gentlemen on my right were.

The way this began was at the White House when a number of us met with the President to discuss this issue. We spent a good deal of a morning in preparation. We then met with the President informally before lunch, had lunch with him, and then had a wrap-up session.

Out of that meeting came the idea of—well, the White House encouraged those of us who attended that meeting to put together a task force or working group to examine some of the issues that we brought up to the President and the gentlemen on my right have done the work.

The fellow from Fairchild was Dr. John Naugle, and you probably remember John. He is in Paris today so I am substituting for John. I can't claim to have done the work, but I can claim to have followed it on an inchstone basis.

Mr. BROWN. Well, without knowing the full content of your recommendations, but just on the basis of what you have indicated needs to be done here, I think that these kinds of recommendations would meet with a fairly ready acceptance in the Congress, particularly if the prestige of the President is behind them, and I would hope that that could be done as a major new initiative and it, I think, would be very helpful toward our commercialization efforts.

Now, there is an ingredient here which is a little hard to define, but I—because it's an intangible—and that's the role of imagination and leadership on the part of both Government and industry.

I'm led to go back 500 years to when Columbus went to Queen Isabella and said, "I've got a bright new idea here. How about a little government cost-sharing?" and at long last, he succeeded in selling the idea of exploring for the new world, and it's probably the best example of a little imagination that produced a lot of commercialization over a long period of time.

Now, we need some sort of a similar infusion of imagination here and basically that means someone up there—it would be nice if the President did it, but it doesn't have to be—were to see some long-range goals for the Space Program which would sort of serve as a magnet for a lot of this activity.

For example, if it were to, say, involve colonizing the Moon, most of this commercial activity would follow along because we're going to have to do a lot of processing of materials to construct habitations and manufacturing facilities on the Moon if we're really serious about inhabiting it, or if we're going to put fairly large-scale human habitations in space, whether on the Moon or anyplace else. It would provide a kind of a long-range goal that I think would incite the imagination of a lot of commercial enterprises.

I think we've been trying to achieve this in this committee for a long time, but we always come up a little short because anything

we imagine, we also imagine how many billion dollars it's going to cost and that has a chilling effect on us, but the need for that vision is really going to be a driving force here and I would hope that we'll be able to achieve that in some fashion.

Maybe I could elicit some comments from you along those lines. I like the vision you have, Mr. Kline, maybe you could comment on this.

Mr. KLINE. I share you comments in many directions, Mr. Brown. I would just comment or add back to the earlier sequence that we followed with the space commercialization task force study group, which has reported its results now back to the administration through—to Craig Fuller and to his staff. We have also briefed various staff members within Congress and John Naugle, that Jack Townsend referred to before, myself and Bob Hood have also made a deliberate effort getting together with different areas within Congress to explain to the limits that we could how we felt about each of those issues and we have gone through that process.

The second thing I'd like to comment about in sharing your view about the long-range goals is the matter of credibility but it is upon credibility that we really are going to found—or we are going to rest the case to which private industry is going to invest its hard-earned dollars. It's got to decide whether the shuttle is really for real or whether the shuttle is going to wither and die and become a research vehicle or—and when we talk about a space station, whether that is a figment of our imaginations, as it was talked about back in 1969, or whether it is a reality that someone who is going to be investing his own profit dollars in can rely upon as being available in the 1990's.

When that confidence is instilled in the minds of the entrepreneurs, we will then find that kind of reaction for which I believe the American people can be well proud of for their industry.

Mr. BROWN. Well, I'm—I want to be as practical as the next person about this. Going back to Columbus for a minute, you know, it wasn't too many years afterwards that entrepreneurs, without any Government subsidies, formed trading companies and so forth because they saw the resources that were available and private business in the United States and around the world will do that when they begin to see the resources that are available.

But you're stymied at the beginning if somebody doesn't have the vision to explore and this is the sort of thing that we need to encourage, hopefully on a little bit more pragmatic basis than Columbus did, but with the same sort of vision involved.

Mr. HOOD. Mr. Chairman, if I could comment just one second on that, we're hoping that the EOS process, which is the manufacture of pharmaceuticals in space, will eventually be that kind of a vision that when it gets to the marketplace will stimulate other entrepreneurial activity in space.

The problem gets to be that you need more than one or two companies in this, and as I think Mr. Beggs pointed out earlier, we have been 10 years getting this far, yet to see any return on our money, and it's all McDonnell Douglas money.

I think the other point that I would just like to make is that he was asked this morning about the difference between commercialization and privatization, and I look upon privatization as being the

ultimate goal that we have all the challenges with and I think you get there by increasing the commercialization, which is the bridge between where we are now to where we fully utilize free-flying spacecraft, like Dr. Townsend's developing and the EOS manufacturing facilities and the space station alike. I don't think there's any doubt in my mind, however, that that market does not exist today, and it is a very—it's challenging because it is high-risk and it's large number of dollars, believe me, to get into it and we need, at least up front, a partner, and I think that partner has to be the U.S. Government.

Mr. BROWN. Well, I don't think there's any question about this. One of the problems that I see with some of this discussion of commercialization is that there are some persons, and they're both in Congress and in the—and in the private sector, who see the taxpayers putting an awful lot of money into space exploration and they just want to get their hands on part of it. They're not really trying to create new wealth. They're trying to get their fingers into a cash flow that's very large and that's not the way you develop the future of this country.

You've got to create new ideas, new resources to create new wealth and that process needs to be nurtured along and your suggestions, I think, are quite realistic as to how we nurture that process along.

We can stymie it by too quick an effort to turn it over to—or some portion of it—to the private sector just because they can do it. They can do it, but it may stymie the further development of the program if that becomes our sole goal or our sole obsession, to let the private sector handle it without recognizing that we're partners in building a—exploring a new frontier here.

Mr. Chairman, I won't belabor this further.

Mr. VOLKMER. Thank you very much.

The gentleman from Virginia.

Mr. BATEMAN. Mr. Chairman, I don't have any questions at this time. I have been reviewing the statements, which unfortunately, I didn't get to hear your presentations because of some distractions, and thank you very much for the input that you've given the committee and I find the statements very, very helpful to formulating in a little bit more specific way the cast of my thinking.

I think it's a very fine contribution that you're making.

Mr. BROWN. Mr. Chairman.

Mr. VOLKMER. Yes, the gentleman from California.

Mr. BROWN. May I go back just briefly? I wasn't thinking very systematically.

Mr. VOLKMER. We have until 4:40 before we have a vote.

Mr. BROWN. All of you gentlemen seem to be focusing upon the matter of manufacturing processes in space and the creation of new products. Of course, you know, our foremost commercialization activity so far has not been a product in the usual sense, but it's been the service of improved communication. There are other services that can be performed in space and I hope that you have devoted some thought to these. The kinds of things that I have in mind include improvements in communication, the possibility of the greater utilization of our earth remote observing capability for

a host of services that could be very important to all of our society and other things in that area.

Has that been included in your thinking about commercialization?

Mr. TOWNSEND. Yes; it certainly has in my own case. We are one of the competitors for the Landsat commercialization and we would use the same spacecraft, which we call Leasecraft, for this kind of work, as well as a carrier for factories in space, hopefully, McDonnell Douglas' factory, but we have looked at those markets and we think there are markets there. There are certainly markets in meteorology and oceanography, land remote sensing and in the solid Earth.

The question is how large they are and how much commercial activity they'll support. That's the critical question.

Mr. BROWN. Is there—is there any—do you perceive any major obstacles to proceeding to develop these markets? We've spent a lot of time discussing them here, but I'm interested in knowing where the obstacles are and what can be done to overcome them.

Mr. TOWNSEND. Well, I think the principal obstacle right now is that some of this technology is, relatively speaking, in its infancy. The market doesn't exist; it has to be created. People have to be shown how to use Landsat pictures, how to route ships with wind data obtained from satellites and things of this nature. You're in the toughest kind of business—that is, where you are out to create the market that you're going to sell to. This is a no-no for MBA's, I guess, you know, you're not supposed to do this.

But in many cases, we are doing that. We are creating brand new markets and we're trying to serve them at a stage when it's only partially clear how big they are, and most importantly, how fast they'll grow.

Now, my feeling in—certainly in the case of the earth-viewing satellites, that market is there; it will grow, but it will take longer than I think some enthusiasts feel it will take.

But when we talked to the president, Mr. Brown, his interests were almost identical with yours. He wanted to create new economic activity; he felt there'd be a technological spinoff or fallout that would benefit other parts of our economy from space commercialization. He was interested not only in what you do in space, but what you would learn in space that you then apply to the ground. That's another aspect of all of this. And he was quite an enthusiast.

We told him, interestingly enough, that we felt the space station was very, very important, that that was the kind of visible commitment, both to the world and to this nation, that we meant business and that those of us who choose to risk our money would—could pretty much count on the shuttle being there so the space station and the shuttle got pretty well tied together there in that discussion.

Mr. BROWN. Well, the President may not be all bad. I'll have to start looking at——

Mr. TOWNSEND. Yeah, I——

[Laughter.]

Mr. TOWNSEND. Let's put it this way. I've met him before and I was most encouraged. I'm a space cadet—that's not news to anybody—but I was most encouraged.

Let me tell a little humorous story, though, about the Columbus thing. I believe it's true. When they had the debate with the President on whether there should be a space station proposal in this year's budget, Stockman is alleged to have put up the fight that I would expect any Director of OMB to put up, and finally the President said, in effect, "Well, I'm glad you weren't around when Columbus went up to Queen Isabella." Now that part, I think, got in Aviation Week. The crack, though, from Stockman didn't, and that was, "Yeah, and she had to hock her jewels to do it, too." [Laughter.]

Mr. BROWN. Thank you very much.

Mr. KLINE. I might add one other point here re the report that we put together. Indeed, we have included within that services that would be involved in it. What we did do was we did not put much emphasis on communications because we considered that of the space commercialization activity to be rather much more mature than the other burgeoning things that could come about in this direction.

I would submit there's one other thing to think about and you'll find that in the more expanded testimony which I am giving you, and that is that there is another class of services beyond those and that is, experimentation that one might do in space which will not produce a product or even an observation, but a better understanding of what goes on on the ground.

That can refer back to better understanding a process for development of a product on the ground, ranging even to a better understanding of the vestibulous system of the human body, and so there are other classes that I think if we can unleash some imaginative thinking on this, we'll be able to take advantage of space in that way, too.

Mr. BROWN. Well, we haven't been discussing here the role of space in contributing to our fundamental knowledge of the universe, which for many of us is a very high priority, but your example illustrates that, in terms of enhancing our knowledge of the Earth, as well as enhancing our knowledge of that which is beyond Earth, the space program, in my opinion, would be worth every cent we've spent on it just because of that, but those are not in the normal sense of the term "commercially marketable" kinds of results.

Mr. KLINE. Yes, sir.

Mr. TOWNSEND. And interestingly enough, John Deere, who was represented by their chief executive officer in the White House—and as you know, their interest is in learning more about cast iron. They use a good deal of it in their tractors, and what they propose to do is to learn something about the fundamental casting process in space and then apply that on the ground. They would never try to make cast iron in space, but on the other hand, making iron with just the right ductility and everything is crucial to their business.

Mr. BROWN. Just to follow up on that a little bit, I understand that some of the lunar samples have been sent to certain compa-

nies for experimentation with their utility in developing structures in the event that we should want to utilize the resources of the Moon for that purpose—that is, structures either in space or on the Moon. Now, that is an area which potentially could fit in with a lot of other commercial developments in a very important way and is worth some research effort.

Again, there's no short-term payoff for that, but there may be a payoff a lot sooner than many people think in, say, the 10- to 20- to 30-year range, and nobody's going to do that unless the Government has the imagination to demonstrate some leadership in that kind of area.

Mr. VOLKMER. Thank you.

I have a few questions. One is do you have any idea how long it'll be before the White House makes decisions on recommendations that were made by the task force? Anybody want to venture a guess or——

Mr. BROWN. Just before the elections. [Laughter.]

Mr. HOOD. I certainly don't, Mr. Chairman.

Mr. VOLKMER. None whatsoever. Now, those recommendations were made when, back last December?

Mr. TOWNSEND. Oh, no.

Mr. VOLKMER. No? When?

Mr. KLINE. The process we worked through was we put together our first shot at recommendations December 3, of last year and then we have gone through an interactive process now that a set of representatives from each of the various departments of the administration have been selected, and we have gone through briefings to them which have been followed by follow-up discussions which we've had with them, leading, as best I have seen it, toward some kind of a process in the middle of the summer as they have brought it to us, but we're not really—at least, I personally am not really in the middle of the details of this.

We've served more as a matter of providing input to them.

Mr. TOWNSEND. There are, in those issues, a number of options that—some of which I think will require legislative action. The majority of them, I believe, can be handled in the executive branch, but there are some that will require legislative action and those decisions have to be taken.

There are also a number in there that the Treasury Department has some trouble with, and again, I give credit to my friends at OMB, they have to keep the budget down. I assume that the people in Treasury have to keep collecting taxes.

They were opposed to virtually everything. That may not be quite fair, but almost, and again, those options—and there are options—have to be examined and decisions taken on which way to go. That process—I would agree with the gentleman on my right that it's probably mid to late summer. I doubt very much whether it will have much impact on the election one way or the other.

But it—there are some pretty far-reaching implications to some of these things. A number of them are trivial—at least I think they're trivial. They're not trivial legally, but they're trivial, like our laws clearly do not permit the investment tax credit to go to things that you can't touch literally in the United States. That can be taken care of. It was taken care of for communications satellites.

The question of import and export. That seems to me to be kind of a silly thing. You manufacture—he manufactures a drug. I think he'd be pretty upset if Treasury were there wanting to charge, you know, a tariff or something when he brought that product back.

Those things, I hope, can be taken care of. There are some stickier wickets, though, in the R&D tax credit area in which there are a number of ways to go, and there's the general question of how—if Government support should be present and if so, how the Government should support some of these ventures or help support them or facilitiate them, whatever word you want.

Mr. BROWN. May I make a comment at that point on the tax credit, Mr. Chairman?

Mr. VOLKMER. Yes.

Mr. BROWN. As you know, the whole question of extending the R&D tax credit is up for graps right now and a number of analyses have indicated this may not be the most productive way to encourage R&D under some circumstances. The direct Government partnership might be more useful than the R&D credit and I think that may be a factor in the problem the administration is having with regard to making decisions in areas such as that.

Mr. TOWNSEND. I don't think it's a problem they have in making the decision; I think it's a problem they have in studying all sides of the issue and preparing the material for decisionmaking by the higher echelons. I mean, you have to distill this down, get both sides of it in about two or three lines and then, here's option 1, yes, no; here's option 2—I guess you've seen Presidential papers along these lines.

There's a good deal of work that has to be done because you have to be fair to the other agency in how you phrase something and the words are very meaningful because sometimes you can prejudice an issue just by your choice of words.

Mr. VOLKMER. You all have worked to some extent, some more than others, with NASA on commercialization features. Do you all have any ideas how we can improve NASA's—let's say, work in the commercialization area?

Mr. HOOD. Mr. Chairman, I'd like to take just a quick stab at that. I think the most important thing that has to happen next is that NASA has, in its own right, to send the same signal to the commercial world and to the free world that you sent on space station, and that is, that we're willing to organize ourselves to pursue that on a very vigorous basis.

I think to this time, we have not seen that, and I think until we do, there is a reluctance on the part of private enterprise to get themselves involved and make the commitments that they have to make in both risk capital, as Mr. Beggs pointed out, and for the length of time that they have to have that capital invested. Each chairman of a company has a fiduciary responsibility to his stockholders and without seeing the kind of a commitment on the part of NASA, I don't think they're going to move out.

Mr. VOLKMER. Anybody——

Mr. TOWNSEND. I'd second that. I think that the three of us that you see here have either worked for—I guess we all three worked for NASA, haven't we—you did. I know I did. You didn't. OK. But

two out of three of us worked for NASA and we've all worked with NASA.

Now, in that sense, we're pros of knowing how to approach that organization and believe me, it's not always very straightforward. It's not monolithic, as Jim frequently testifies, and even—even those of us who are professional in this business have had some problems with these JEA's, just getting NASA to focus on the problem, and I think that is both organizational and it's the fact that something new is happening here, for which there is no charted course.

I would agree that NASA has to send a clear signal, I think both through organization and through actions, that they mean business here and the signal will be important, I think, to NASA people, as well as people in the outside, because there are some people in NASA that don't view commercialization as necessarily good news.

Mr. KLINE. I'd second that point, also. I think that the issue that I would add to this is the emphasis on providing a central high-level NASA office. I think you've got to start and send your signal through your own organization.

The second thing is that I think that when actions are taken, they have to be done in the context of what else has been going on. And over the past year's time period, we've seen several demonstrable actions. We have seen the creation under Elizabeth Dole of a Space Transportation Commercialization Office that has gone on. We have seen considerable hype on the idea of space commercialization activity.

If now, having done that, we turn to our fiscal year 1985 budget and then we do not take some kind of an action relative to the space commercialization, we will be sending an unmistakeable signal to the industrial, nonaerospace world that says we're really not serious.

So I think that the issue really turns upon us quite critically right now as far as what we do.

Mr. VOLKMER. The gentleman from Virginia wish to——

Mr. BATEMAN. If I might, Mr. Chairman, I'd like to react in a sense to the comments just made, not in any way in disagreement with them, because I think it's a very understandable and supportable sentiment. Being here no longer than I have, I'm a terrible one to prognosticate as to what we can at this point or not do with reference to the fiscal year 1985 budget. But for whatever it's worth, I think the aerospace industry can take great comfort that this committee is going to be very supportive of these kinds of initiatives because I have heard no sentiment anywhere on the committee which is contrary to or demonstrating a concern on the part of the committee, and I think hopefully of the committee, that these things should be supported.

It would please me very much to fine tune the authorization bill for NASA before it reaches its final consummation to do some of these things so that that signal becomes clearer. The only thing I would add, other than whatever comfort that might give to you gentlemen and your colleagues, is to try and clarify the—the attitudinal problem within the agency.

It comes through to me that you're saying that there's no hostility to commercialization on the part of NASA, but there is not that

degree of affirmative, positive, let's-go-out-and-make-things-happen attitude that you feel would be important.

There again, this member of the committee will be certainly interested in trying to stimulate that more positive climate.

Mr. Chairman, there are some other things that came to mind, but I'm trespassing on your time and so I will suspend.

Mr. VOLKMER. I would just like to mention to the gentleman from Virginia and the panel also that this subcommittee has been very supporting in trying to get NASA to establish an Office of Commercialization and we're going to continue to do so and I think, too, that it would, as the gentleman from Virginia said, maybe put them on the right frame of mind to start being more positive, rather than just passive.

I'd like to go into another area that, Dr. Townsend, you mentioned—and I know that Mr. Hood and McDonnell Douglas are already working under it—and if you don't want to give us any ideas now, perhaps you can later in writing—and that is, on the joint endeavor agreements, how could those be modified so that it could be improved and more streamlined if at all possible? Have you looked at that at all?

Mr. HOOD. I'm not sure I'm ready to comment, Mr. Chairman. I'd like to ask our people who worked on it on a daily basis. I would only go to say that we're one of the early ones and helped kind of form the whole thing so, having gone through that process, I'm sure that it's getting a little bit easier the second and the third and the fourth time and maybe Jack would like to speak to that, but I think that it's fair to say that we experience nothing but the fullest cooperation with NASA in going through this program.

Mr. VOLKMER. But if there is anything, we would appreciate it.

Mr. HOOD. Yes, sir.

Mr. TOWNSEND. I think the biggest problem is that it is a new field. They're plowing new ground with each of us and there is no standard operating procedure, if you will, under which NASA operates.

In my testimony, I say there's a need to define how one proceeds with the JEA. What we've had the most trouble with was to get NASA to focus because these JEA's involve everybody. They involve program offices, sometimes two program offices, for example, Science and Applications, maybe the manned space flight. It involves procurement people, legal people. It involves the Office of the Administrator. Getting all these people together and it's kind of like the problem of getting all the horses in the starting gate at the same time.

That's a little bit difficult when there is not a standard procedure for it so that, I think, does need attention and it will become easier.

Now, the point here, I think, is not so much for us old NASA hands, if you will, but for the new companies, the startup companies, the companies that don't know how to approach the system because otherwise, they could spend an awful lot of time and money, and they don't have very much of either, to, you know, just in getting educated.

Mr. HOOD. I think, Mr. Chairman, that gets back to our point of organization again. There's really no visible, you know, point where this thing all comes together.

Mr. VOLKMER. For anybody to really go to, there's no visible point to start out with.

Mr. Kline, you addressed in your statement the matter of these centers of excellence, whether you call them low-g or what, and the establishment of a joint—what, industry/university task force to develop the areas, I guess, in which the centers would work, would do the research on.

I have no basic objection to that except we're already at the point, to some extent, anyway, that we're having some centers ready to be formed. Now, do you envision in the future that we will continue to form these centers for different areas or——

Mr. KLINE. What I——

Mr. VOLKMER [continuing]. That's what I——

Mr. KLINE. Excuse me.

Mr. VOLKMER. That's what I'm trying to get into is—in other words, that they would continue to be developed into other areas as they become possibly commercialized or for purpose of doing basic research that could be possibly commercialized.

Mr. KLINE. Yeah, our thought really was that if you started from the premise that NASA was going to be involved in a general search to establish centers of excellence within various university or possibly other nonprofit organizations, but primarily universities, our idea was to say, if that would be done in a particular technical area—and let me take telecommunications, or let me take the example here of services, or an area here of dialectrics—that it should be possible, and what we were urging was that it should be possible to make use of those centers of excellence and with very small additional effort have them consider also the possibility of zero-g applications related to that particular technology. And we went only that far.

We felt that if something like that was set up in various areas and evolved on a case-by-case basis, but with encouragement from the Government, that something very healthy could come out of that because not only would we have an increase in the communications between the educational institutions and the Government and also various industrial organizations, quite possibly—probably nonaerospace—but that we would also be going through the process of educating both faculty and future students to the advantages of a new industry.

Mr. VOLKMER. One other area that's been mentioned here before is the manned space station. How much Government involvement can we see in the manned space station as far—I mean, not Government, industry involvement, excuse me, industry involvement, private industry involvement—I'm not talking about aerospace industry in building them now. I'm talking about private involvement in actually participating or putting up a module or part of it. How much can we see in the future?

Mr. TOWNSEND. Well, I think there are a number of possibilities. In the first place, there are a number of things we see dimly down the road that will require man's presence to make in space. There will be some things that will be very difficult to produce in a total-

ly automated fashion. I see that kind of activity, if not on the station, very close to the station.

There are certain research and development activities that would be directly connected with products, either to be produced in space or to be produced on the ground, that again require the presence of a man and I think there would be investments, if you will, of those of us in industry who have those interests.

I don't know that anybody is going to come along and offer to build a module, but I do think that there are a number of us—and I know for a fact that McDonnell Douglas is interested in this—that would use the space station, both in an R&D and then possibly in a production mode if it were there.

I think it holds a lot of promise in that connection.

Mr. HOOD. I'd second that, Mr. Chairman. I think it really depends upon how big this market really gets to be, but even in that regard, let me say that on the EOS project, we have flown four times now with man in the loop every time and we'll fly the fifth time with Charlie Walker, our payload specialist, next Monday, just in designing the equipment that will ultimately end up operating in a full automated mode. So even where you do have a process that you're going to automate, man is going to become very, very much involved in it and it makes no sense to design equipment on the ground that you're going to operate in space for any long periods of time.

Mr. KLINE. I guess I would add just to say that a lot of what you do is based on the way you set your ground rules to begin with. One of the words that's been used with the space station is to say that it should be something which is "user-friendly." I think that while that is a maybe over-used phrase right now, I think that if the clear intent to begin with is to say that we, the U.S. Government, would like to put up a manned space station which has the capability of either being used by commercial interests or B, having adjuncts added on to this thing at appropriate times when it is seen fit by private industry to do that, if that kind of a push is made to begin with, I think we'll see a lot more develop out of the final system and I recommend we do that.

Mr. VOLKMER. Is there anything that you can see, other than creation of the office and trying to put things together within NASA on a commercialization, any other ways that NASA could help develop markets for space-based products or services? Other than the recommendations you got on the task force here.

Mr. HOOD. Not I, Mr. Chairman. I think if those kinds of recommendations are endorsed and developed, that industry will, in fact, develop the market on its own and really make it or break it.

Mr. KLINE. There is one technique which I would suggest and that is that we have put together our recommendations. They are the best judgment that we have at a particular point in time, and I think that—I hope that what we've done has been as good as we can make them right now, but I think that if something were worked out where in a year or 2-year time period, an organized follow-up were requested by your office, I would think that that might be a constructive way to keep pressure on to have us do it. [Laughter.]

Mr. VOLKMER. Well, we'll probably do it more often than a year. [Laughter.]

I have no further questions. I just wish to thank all of you for taking your afternoon here to be with us and assist us on the hopefully progression into more commercialization in the space field altogether in the various areas and that we'll see some of the visions, as the gentleman from California has shown us, 20 years from now or 30 years from now and so maybe we can do what's needed to be done now to be there at that time.

Mr. TOWNSEND. And we thank you, Mr. Chairman.

Mr. VOLKMER. Thank you very much.

Mr. KLINE. Thank you, Mr. Chairman.

[Whereupon, at 4:35 p.m., the subcommittee was adjourned, to reconvene subject to the call of the Chair.]

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